The Glass Industry
REG. U. S. PAT. OFF.

Vol. 8 MARCH, 1927 No. 3

American Ceramic Society's Annual Convention

Detroit Meeting Breaks All Previous Records

The 1927 meeting of the American Ceramic Society, held at Detroit during the week of February 14th was one of record breaking proportions. In attendance and in the number of papers presented, it eclipsed all former standards. The meetings of the Glass Division were marked by enthusiasm. The value and importance of the papers read before the division has not been equalled at any previous occasion.

Registration at headquarters, established in the Book-Cadillac Hotel, Detroit's leading hostelry, was heavy. Beginning on Sunday, February 13, the numbers desiring to register on Monday and on Tuesday mornings taxed the facilities of the office force to the limit. A number of members, unable to spare the time necessary to attend the whole meeting, arrived as late as Wednesday morning, rather than forego attending the convention. All through the week there was a live spirit. The opinion was voiced by many that the Detroit meeting has been the best ever held by the Society.

BOOK-CADILLAC HOTEL

The General Session

The General Session, held in the ballroom of the hotel, was well attended. The outstanding feature of this meeting, after the President's address and the General Secretary's report to the Society had been read, was the conference led by the Research Committee. The subject discussed was one of the utmost importance to the American Ceramic Society, and one that has had the support of its leading members, "An American Ceramic Research Council." The discussions of the plans laid before the meeting by Ross C. Purdy, general secretary, were received with intense interest, and although there was some opposition, the large majority of those present favored the proposals.

Full Time Chief Research Advisor Needed

The principal feature of the plan is the appointment of a chief research advisor, employed full time, and the creation of a staff of representatives from trade groups and associations, to meet at frequent occasions. The research advisor and his staff would study problems proposed for investigation from the standpoint of what is known, its feasability, the research facilities available for its prosecution, and its probable cost.

It is believed that as a beginning, a sum of $15,000 will be sufficient. If a man of outstanding ability can be found, who can give all of his time and energy to the demands of the position, the great difficulties incident to the carrying on of research under present conditions will be eliminated.

It was decided to hold the next annual meeting of the Society in Atlantic City.

Technical Sessions

Tuesday and Wednesday were given over to divisional meetings. The Glass Division convened under the chairmanship of F. C. Flint, assisted by C. H. Modes, vice-chairman. Limitations of space do not permit extensive abstracts of all of the papers presented, in this issue. For this reason, some of them will be mentioned only briefly, to be reported more completely in a later issue of this journal.

Many of the members enjoyed the exhibit of art glass and pottery at the Society of Arts and Crafts, where there was a remarkably fine collection of glass made by the great artist-glassmaker of America, Frederick Carder, of the Corning Glass Works. The smoker on Tuesday evening and the annual banquet on Wednesday evening were great successes. On Thursday and Friday the members visited the River Rouge plant of the Ford Motor Company, the Buckeye Clay Pot Company at Toledo, and the Toledo Glass Company.

New Officers Elected for 1927-1928

President: B. Mifflin Hood, Mifflin Hood Brick Company, Atlanta, Ga.

Vice-President: MacDonald C. Booze, Chas. Taylor Sons Co., Cincinnati, O.

Treasurer: H. B. Henderson, Standard Pyrometric Cone Co., Columbus, O. (re-elected).

General Secretary: Ross C. Purdy will continue to fill the office.

New Officers of the Glass Division

The officers of the Glass Division for the ensuing year were chosen by unanimous vote, upon nominations made by the nominating committee. The following were elected:

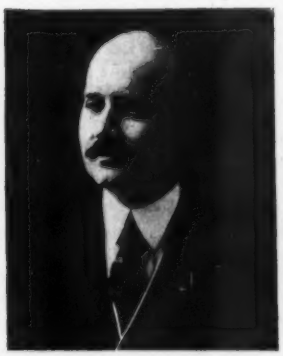
Chairman: H. L. Dixon, H. L. Dixon Company, Pittsburgh, Pa.

Vice-Chairman: C. D. Spencer, National Lamp Works of General Electric Co., Cleveland, O.

Secretary: A. N. Finn, Bureau of Standards, Washington, D. C. (re-elected).

Trustees: R. L. Clare, E. Ward Tillotson, R. R. Danielson, J. C. Hostetter, J. S. McDowell, Ercill C. Hill, A. V. Bleininger, Paul E. Cox.

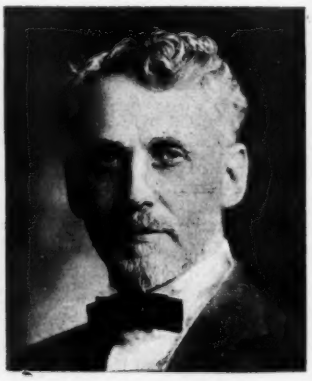
Officers of The American Ceramic Society, 1927-1928



B. MIFFLIN HOOD
President

MACDONALD C. BOOZE
Vice-President

H. B. HENDERSON
Treasurer



ROSS C. PURDY
Secretary

Among Those Attending Glass Division Meetings

Name	Business Association	Address
Geo. Aurien,	Mississippi Glass Co.	St. Louis, Mo.
W. F. Brown,	Libbey-Owens Sheet Glass Co.	Toledo, O.
M. C. Booze,	Chas. Taylor Sons Co.	Cincinnati, O.
W. L. Brownlee,	Buckeye Clay Pot Co.	Toledo, O.
W. V. Brumbaugh,		Pittsburgh, Pa.
W. F. Curtis,	Fostoria Glass Co.	Moundsville, W.Va.
G. P. Cole,	Dominion Glass Co.	Montreal, Canada
J. W. Cruikshank,	J. W. Cruikshank Eng'g Co.	Pittsburgh, Pa.
R. J. Clark,	A. A. Simonds-Dayton Co.	Dayton, O.
H. L. Dixon,	H. L. Dixon Co.	Pittsburgh, Pa.
A. W. Dodge,	Hazel-Atlas Glass Co.	Zanesville, O.
A. N. Finn,	Bureau of Standards	Washington, D. C.
F. C. Flint,	Hazel-Atlas Glass Co.	Washington, Pa.
Volney Foster,	United States Silica Co.	Chicago, Ill.
K. L. Ford,	Glass Container Association	New York
R. S. Godard,	H. L. Dixon Co.	Pittsburgh, Pa.
H. A. Golwynne,	Henry A. Golwynne & Co.	New York
A. T. Hauser,		Pittsburgh, Pa.
C. M. Hollingsworth,	Ohio Valley Clay Co.	Steubenville, O.
F. B. Garrod,	Owens Bottle Co.	Toledo, O.
J. C. Hostetter,	Corning Glass Works	Central Falls, R. I.
A. W. Kimes,	*National Glass Budget*	Pittsburgh, Pa.
G. E. F. Lundell,	Bureau of Standards	Washington, D. C.
G. Lufkin,	Illinois Glass Co.	Alton, Ill.
J. F. Littleton,	Corning Glass Works	Corning, N. Y.
P. Gutschow,	Jungmann & Co.	New York
H. H. Miller,	Electrical Testing Laboratory	New York
H. Insley,	Bureau of Standards	Washington, D. C.
D. J. McSwiney,	Consulting Chemist	Columbus, O.
G. V. McCauley,	Corning Glass Works	Corning, N. Y.
V. V. Kelsey,	Erwin Feldspar Co.	Trenton, N. J.
Theo. Lenchner,	Roessler & Hasslacher Chem. Co.	Pittsburgh, Pa.
C. H. Modes,	Illinois Glass Co.	Alton, Ill.
L. R. Milford,	Solvay Process Co.	Syracuse, N. Y.
T. Husain,	Alfred University	Alfred, N. Y.
H. L. MacCartain,	Electrical Testing Lab.	New York
A. E. Marshall,	Consulting Engineer	Baltimore, Md.
A. C. Nixon,		Detroit, Mich.
L. Navias,	General Electric Co.	Cleveland, O.
W. W. Oakley,	Corning Glass Works	Corning, N. Y.
A. R. Payne,	Fostoria Glass Co.	Moundsville, W.Va.
W. B. Pimm, Jr.,	Carr-Lowrey Glass Co.	Baltimore, Md.
D. W. Ross,	Findlay Clay Pot Co.	Washington, Pa.
F. H. Rhead,	American Encaustic Tiling Co.	Zanesville, O.
C. D. Spencer,	General Electric Co.	Cleveland, O.
J. B. Shaw,	Pennsylvania State College	State College, Pa.
W. A. Koehler,	West Virginia University	Morgant'n, W. Va.
K. C. Sanders,	Hazel-Atlas Glass Co.	Washington, Pa.
D. D. Schurtz,	Sharp-Schurtz Co.	Lancaster, Pa.
M. Sinclaire,	H. P. Sinclaire & Co.	Dunkirk, N. Y.
S. R. Scholes,	Federal Glass Co.	Columbus, O.
M. R. Scott,	Bausch & Lomb Optical Co.	Rochester, N. Y.
L. C. Roche,	Maryland Glass Corporation	Baltimore, Md.
H. K. Richardson,	Westinghouse Lamp Co.	Bloomfield, N. J.
F. S. Thompson,	Buckeye Clay Pot Co.	Toledo, O.
E. W. Tillotson,	Mellon Institute	Pittsburgh, Pa.
A. Silverman,	University of Pittsburgh	Pittsburgh, Pa.
J. H. Waggoner,	Mellon Institute	Pittsburgh, Pa.
A. E. Williams,	Hartford-Empire Co.	Hartford, Conn.
W. C. Taylor,	Corning Glass Works	Corning, N. Y.
H. H. Blau,	Macbeth-Evans Glass Co.	Charleroi, Pa.
W. A. Yung,	Consulting Engineer	Pittsburgh, Pa.
H. V. Miller,	General Electric Co.	Cleveland, O.
C. A. Walworth,	Libbey-Owens Sheet Glass Co.	Charleston, W. Va.
E. C. Bowers,	Edw. Ford Plate Glass Co.	Rossford, O.
C. W. Berry,	Mitchell Clay Mfg. Co.	St. Louis, Mo.
R. R. Nickerson,		Detroit, Mich.
J. B. Krak,	THE GLASS INDUSTRY	New York

A feature of unusual interest was the exhibits of raw materials and equipment, arranged on the seventh and eighth floors of the hotel. Among others the following firms were represented:

Bristol Company, pyrometers, Waterbury, Conn.
Chas. Engelhard, pyrometers, New York.
Golding Sons Company, Erwin Feldspar Company, Clinchfield Products Company, feldspar, clays, etc., Trenton, N. J.
O. Hommel Company, glass and ceramic chemicals, Pittsburgh, Pa.
Innis, Speiden & Company, chemicals, New York.
Leeds & Northrup Company, pyrometers, Philadelphia, Pa.
E. Leitz & Company, microscopes, New York.
Massillon Refractories Company, Massillon, O.
Pyrometer Instrument Company, pyrometers, New York.
Roessler & Hasslacher Chemical Co., chemicals, New York.

Technical Papers Presented

In addition to the papers reviewed in this issue a number of others as listed below were presented at the Glass Division meetings and will be treated at greater length in a later issue.

They are:

Design and Service of Tank Blocks, by Donald Ross.

Large Clay Shapes for the Window Glass Industry, by Edwin P. Arthur.

What is the Effect of Oxidation or Reduction Agents on Color Produced in Glass by Selenium, by A. Silverman.

The Petrographic Microscope as an Instrument for the Glass Technologist, by H. Insley.

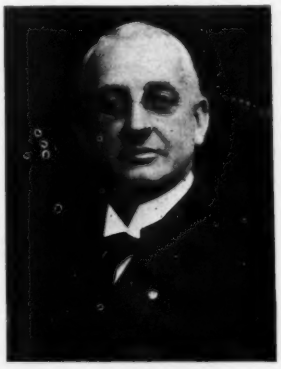
Durox Glass House Refractories, by T. S. Curtis.

Art Design of Glassware, by Frederick H. Rhead.

A Glass Factory in the Days of Nebuchadnezzar, by A. E. Marshall.

New Problems in the Production of Commercial Glass, by F. Eckert.

Officers of the Glass Division, 1927-1928



H. L. DIXON
Chairman

C. D. SPENCER
Vice-Chairman

A. N. FINN
Secretary

The Frosting of Glass by Mixtures Containing Hydrofluoric Acid and Alkaline Fluorides

BY C. D. SPENCER, CLEVELAND, O.

All glasses are soluble in hydrofluoric acid. This acid and its salts form the basis of etching and frosting mixtures. For bright etching or acid polishing of cut glass, concentrated hydrofluoric and sulphuric acid is used. An aqueous solution of the acid, to which alkali fluoride has been added produces an entirely different effect, resulting in matt etching or frosting. The experiments described were carried out with sodium, potassium and ammonium fluoride in varying proportions.

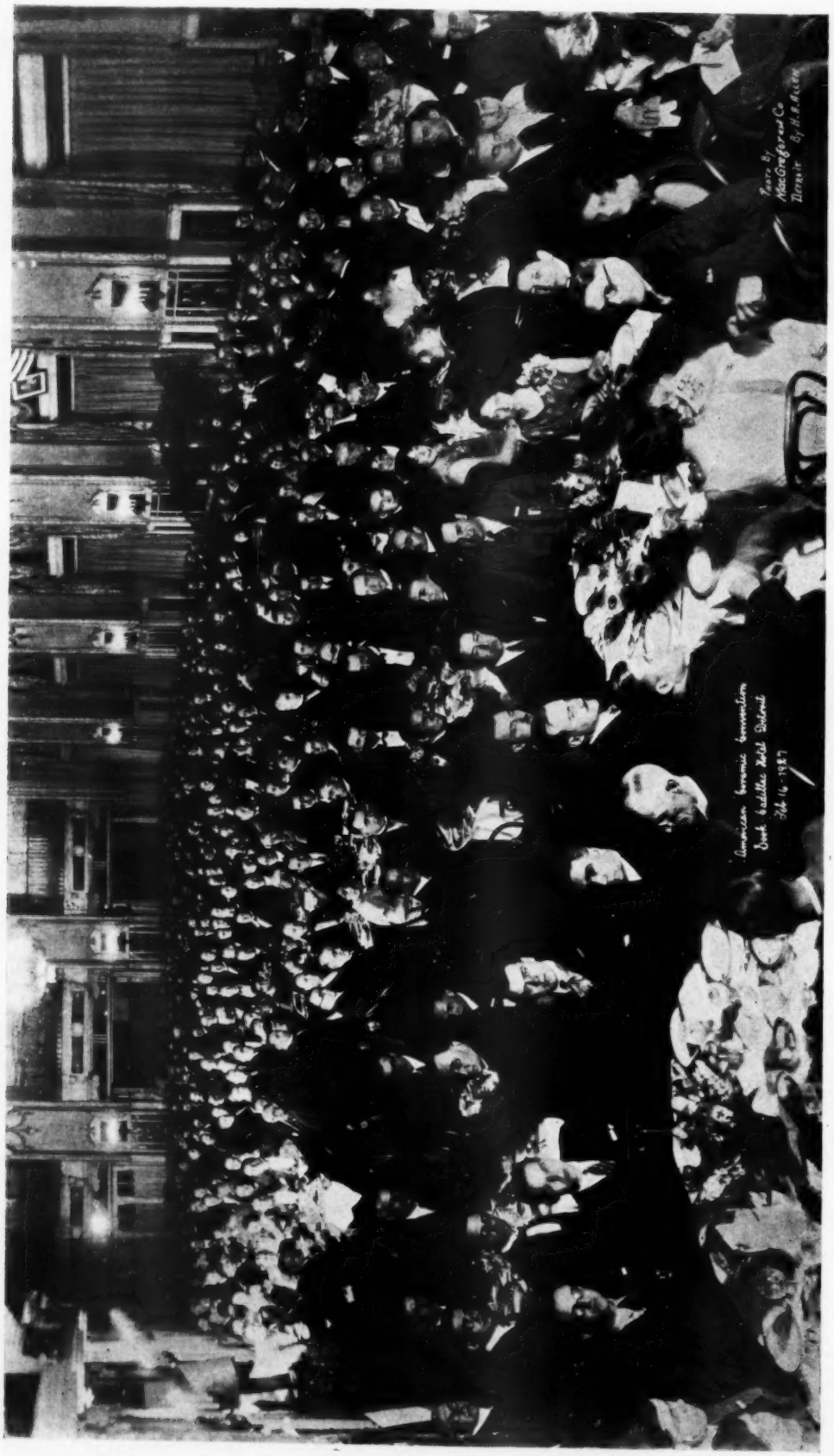
The opacity and the diffusion of etched surfaces is a function of the concentrations of the acid and the salts, and of the time of exposure and the temperature at which the reaction takes place. Besides the acid and the fluorine salts, frosting mixtures usually contain some form of sludge, which acts as a filler or sponge. The sludge may be either an active or an inactive ingredient. The character of the resulting etch can be changed to some extent by addition to the frosting mixture of some inactive salt, such as ammonium sulphate, ammonium chloride or oxalate.

The presence of crystal-like areas on an acid frosted glass surface can be explained by three different theories. One theory assumes that glass has a crypto-crystalline structure, and that the etching depends on the same principle as is utilized in the development of the crystal structure of metals. The second theory assumes that the matt etching is the result of the deposition of a crystalline or amorphous precipitate on the glass surface during frosting. However, there is no evidence of double refraction in the crystalline-appearing areas and, even more to the point, the surface structure of the frosted glass is not changed by treatment with any reagent which does not itself affect glass.

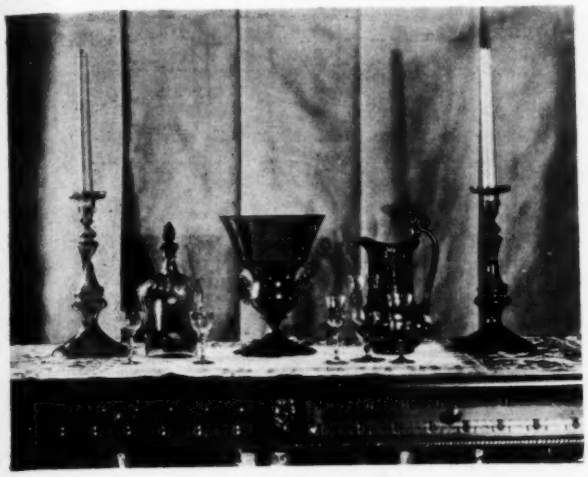
The third or protection theory postulates that these crystalline appearing areas consist of amorphous glass. During acid frosting of a glass surface, crystals of silicofluorides are formed and those crystals that form in contact with the glass surface protect the glass area immediately beneath them from further attack.

To observe the process of frosting, a simple cell was constructed of brass. The cell was about 3 inches in diameter and ¼ inch thick, formed by a section of a brass tube. One face of the cell was closed with a window of celluloid and the other consisted of a screw cap with a half inch hole in the center. The glass specimen to be etched was cemented to the inside surface face of the cap, covering the hole in the center. A microscope was focused on the inside surface of the specimen of glass. The etching solution to be used was contained in a lead dish above the hard rubber funnel serving as a filter. The cell was filled with water and etching solution was added until the desired concentration had been obtained. First a finely divided precipitate was formed at the interface between glass and solution. Then crystals appeared in the solution contiguous to the glass surface. These crystals expanded and interfered with the symmetrical development of the crystals formed subsequently. Dense lead glasses, ordinary soda-lime glasses and heat resisting borosilicate glasses behaved in the same manner.

Hollow ware, sandblasted or acid etched on the inside is very fragile. The exterior can be frosted without impairing the mechanical strength of the article but excessive breakage occurs when the interior surface is roughened. However, if the radius of curvature is increased by a second etching, the glass is again fortified and almost entirely regains its former strength. The chemical composition of a number of frosting and fortifying mixtures has been given by M. Pipkin in an article entitled "The Inside Frosting of Incandescent Lamps" (*Ind. & Eng. Chem.* 18, 774-776, 1926). This article also gives a description of an impact device for testing the mechanical strength of frosted hollow ware. The fortifying action of different solvents for glass depends on the enlargement of the minute fissures formed during the first frosting process.



The American Ceramic Society Annual Banquet at Book-Cadillac Hotel, Detroit
Wednesday, February 16, 1927



ONE OF THE BEAUTIFUL EXHIBITS AT THE DETROIT SOCIETY OF ARTS AND CRAFTS

Smoky Glass: A ware introduced in Europe several years ago by the famous Orrefors Glass Works of Sweden. These designs are also made in white, gray and blue.

(Imported and Arranged by the Society)

The Loss of Silica During Glass Melting

BY S. R. SCHOLES, COLUMBUS, O.

Repeated analyses of glass taken from an operating tank at different times shows that, when round-grained and dustless sand is used, the silica found in the glass averages 0.64 per cent lower than the value calculated from the batch.

When sharp-grained, dusty sand is used, the loss is greater, amounting to 1.13 per cent. It is suggested that the reason why sharp-grained sand is held to be easier to melt than round-grained, is because of this loss, leaving less silica for fusion.

These results are confirmed by the data from other analysts, showing that the percentage of silica found is usually smaller than that calculated for a given glass.

Properties and Service of Glass Melting Pots

BY DONALD ROSS, WASHINGTON, PA.

The mixture of ingredients used in the manufacture of glass house pots must be such that the pot can be successfully dried, and when ready for use be free from strain and mechanical defect. Pots must be strong enough in the unfired condition to withstand handling. The modulus of elasticity and firing shrinkage must be such that the pot will not be disrupted during heating. The pot must be sufficiently refractory so that it will not soften, deform or squat in the furnace. It must have sufficient tensile strength that it will not tear from the strains to which it is subjected during shrinking in the furnace and from the pressure of the glass within its walls. In addition its rate of deterioration under the action of the molten glass must not be excessive.

The materials used in the manufacture of glass pots consist of refractory fireclay "bond" and crushed burned fire clay "grog." The bond clay must possess great bonding power, both in the dry and fired conditions and is in the majority of cases used only in sufficient quantities to insure enough strength of the pot. An excess of bonding material may result in cracking of the pot during drying.

Mixtures of raw clay and grog shrink in firing, and it is necessary that this shrinkage be kept reasonably small, or the pot may become strained or may crack. It is desirable that the pot surface shall be of a uniform and rather tight structure, as small pores are more resistant to attack by the molten glass.

Pots are usually shipped in the unfired condition and as the average size pot ranges from 2,000 to 3,000 pounds each, this great weight requires that the dry strength must be considerable.

After pots are once properly dried, further ageing does not make them any better. In dry fall weather, pots 3 months and 10 days old were found to contain 1.1 per cent of moisture, which could be driven off at 100 deg. C., while on the same day pots one year and 3 months old were found to contain 0.85 per cent moisture. Weather conditions affect the moisture contents of pots to a considerable extent. The strength of pots in the unfired condition varies inversely to their moisture content. A pot that has become damp only regains its strength by being dried out again.

There is more moisture on the average summer day than in winter; on rainy days the atmosphere contains more moisture than on dry days.

The early stages of firing clay wares can be considered as merely a continuation of drying, carried on at successively higher temperatures. Rapid variations of humidity and temperature must be guarded against. It is safe to raise the temperature of the pot arch to 140 deg. F. in three hours after the fires are lit, but from this point on the usual precautions should be observed.

As the pot approaches the maximum temperature which it reaches in the pot arch, it is desirable that it receive the same heat treatment on the bottom as on the top, otherwise uneven shrinkage is apt to set up strains, that may disrupt the pot. It is further desirable that the pot be brought as near furnace temperature as possible before it is moved from the pot arch, to minimize unequal heating.

Unequal heating of the front and the back of the pot in the pot furnace is lessened or accentuated by the character of the fire. A "rash fire" in the pot furnace, i.e. a short flame that burns with an intense white heat as it rises from the eye of the furnace, and having the tip of the flame near the crown, accentuates unequal heating of the pot. It makes the back of the pot unduly hot, while the front tends to be too cool. A "soft fire," one that is not too strongly oxidizing and in which the flame extends throughout the furnace, burning in contact with the pot, and from which the flame occasionally leaks out of the furnace, tends to equalize the temperature. This latter condition is favored by low stack draft.

It is advisable not to make capacity melts in the pot, for the first few times, and to make the early melts of relatively non-corrosive glass, if this is possible. In use the pot gradually burns dense. If it shrinks greatly during this period, the head is apt to "hang up" on the "breast wall" and injure the pot. If the pot is not rigid enough it will "squat," sometimes to such an extent that it must be broken to pieces before it can be removed from the furnace through the arch which it entered.

When the furnace becomes overheated, some of the pots may fail. Failure may consist of tearing up the back of the pot, or of the pot squatting so much that it tears open at some strained portion. The young pots are usually the ones to fail.

As the pots burn dense in service, the pores become smaller and mullite structure develops in the clay.

Looking forward to the pot of the future, we see one having relatively thin walls, which will be sufficiently rigid at glass melting temperatures that it will not squat and rip, and which will be relatively dense as set in the furnace, thus permitting great heat flow even while the pot is young, and insure relatively great resistance to the attack of molten glass and batch.

The Relationship Between Chemical Composition and the Thermal Expansion of Glasses

BY S. ENGLISH AND W. E. S. TURNER, SHEFFIELD, ENGLAND

The results of this investigation show that for most series of glasses the relationship beween chemical composition and the linear coefficient of thermal expansion is approximately a straight line. Notable exceptions occur only in the case of glasses containing boric oxide. The progressive substitution of silica by boric oxide results in either a maximum or a minimum being observed in the property-composition curve. In the case of thermal expansion minima are observed. More extensive investigation may possibly reveal minima or maxima in the thermal expansion curves of other series of glasses, as has been found to occur in the annealing temperatures, electrical conductivity and certain mechanical properties, when silica is progressively substituted by certain basic oxides, as well as by boric oxide. So far as thermal expansion is concerned, this effect has not yet been demonstrated. In the table given on the following page the constants found are given side by side with those determined by Winklemann and Schott.

Oxide	Formula	English and Turner	Winkelmann and Schott
Silica	SiO_2	0.15×10^{-7}	0.8×10^{-7}
Soda	Na_2O	12.66	10.0
Potash	K_2O	11.7	8.5
Lime	CaO	4.89	5.0
Magnesia	MgO	1.35	0.1
Alumina	Al_2O_3	0.52	5.0
Baryta	BaO	5.2	3.0
Lead oxide	PbO	3.18	3.0
Zinc oxide	ZnO	0.21	1.8
Zirconia	Zr_2O_3	0.69	2.1
Boric oxide	B_2O_3	—1.98	0.1

The value for boric oxide is negative, since it has been worked out only for the portions of the thermal expansion curve lying between 0 per cent B_2O_3 and the value at which the curve begins to bend towards a minimum.

New Type of Tunnel Tank Replaces Day Tank

BY W. S. WILLIAMS, GLENDALE, CALIF.

Many branches of the glass industry have recently been affected by the constantly changing market demand for colored lines, specialties or novelties. New effects are enthusiastically received while the staple lines are largely neglected. The manufacturer is compelled to maintain a delicate balance between production and current sales and to keep his assets, organization and equipment as flexible as possible. In order to be able to profit from the making of specialties or novelties, manufacturers are generally using day tanks for glass melting, as these tanks meet the demand for flexible equipment, and the capital investment required is comparatively small. While the day tank has its advantages it does not compare favorably with the continuous tank from the standpoint of economy of operation and fuel consumption.

showing abnormal wear. It will deliver one ton of melted glass for a day's run, or when required it delivers three tons of melted opal glass for twenty-four hours' operation. The melting end is

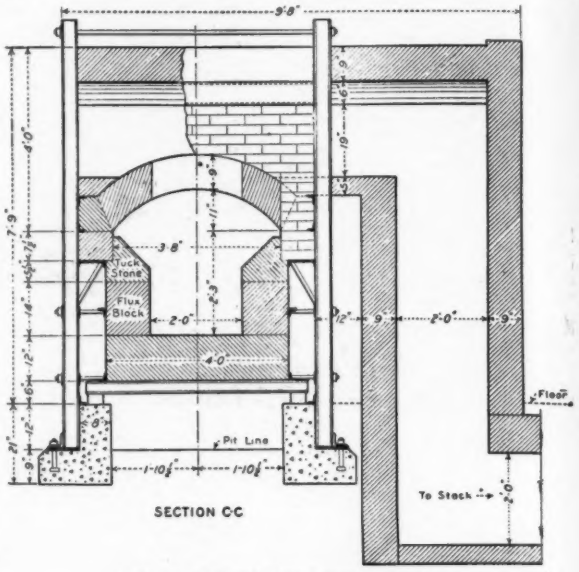


FIG. 2—CONTINUOUS TUNNEL TANK

kept at 2350 deg. F., the cross-flue temperature is about 2160 deg. F., and the working end shows a temperature of 1800 deg. F.

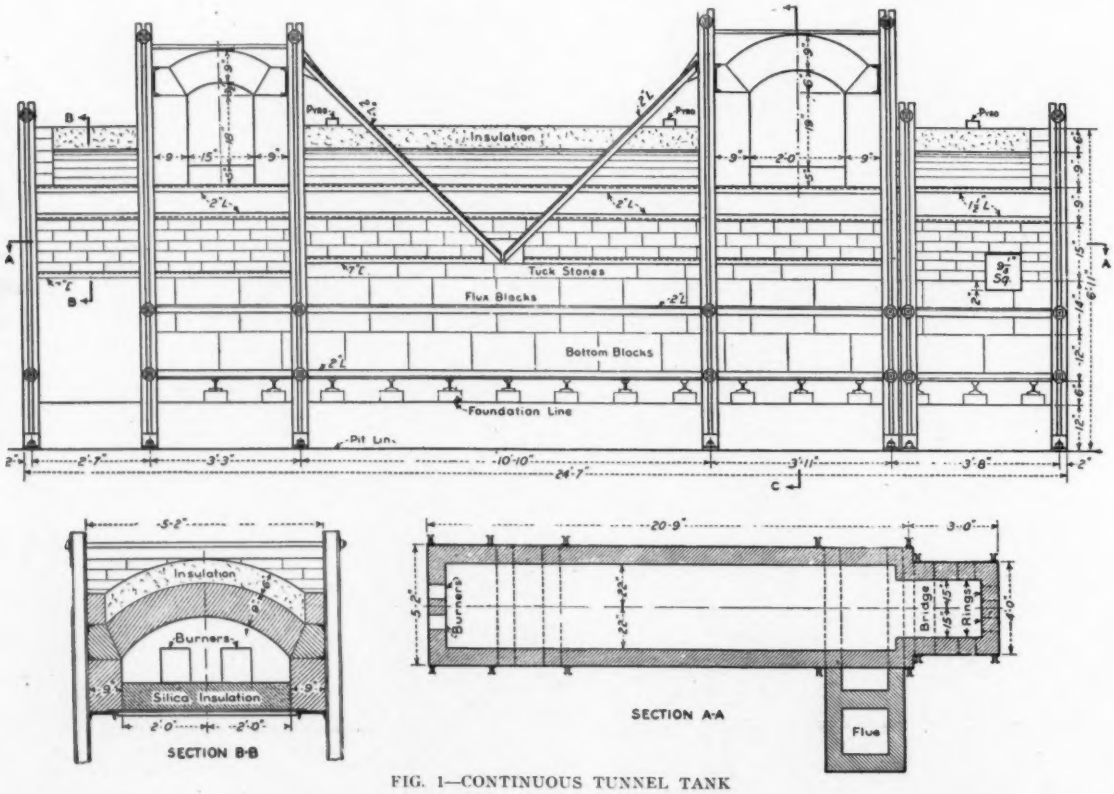


FIG. 1—CONTINUOUS TUNNEL TANK

A small continuous tank was designed with the object of obtaining better fuel economy and more dependable melting conditions. The "tunnel tank," shown in Fig. 1, has been in operation for seven months, melting opal glass for punty gathering without

Total gas consumption averages 33,000 cubic feet of natural gas (1100 B. T. U.) per 24 hours.

Experiences with melting opal glass in the day tank demonstrated that the glass turned "flinty" at the point where the intense

heat of the burner struck the pile of batch and subsequently the glass surface. This led to the underlying principle of design used in the tunnel tank. It is constructed to prevent the flames from striking either the batch or the metal. After leaving a short combustion chamber, the gases are drawn toward the cap by stack suction in the cross-flue on top of the cap at the working end.

The cost of the tank was $1,275. Tank block and tuck stones can be replaced without disturbing the cap, which should last several years. Neither recuperation nor regeneration was used.

The results secured by replacing a day tank with a tunnel tank of equivalent producing capacity per shift are: (1) Dependable production and uniform color; (2) Melting conditions stabilized; (3) Producing capacity tripled; (4) Fuel consumption not increased; (5) Operating cost not increased; (6) Repair time cut, production schedules quickly regained; (7) Repair materials cost reduced; (8) Repair labor cost reduced.

Tentative Standard Method of Glass Analysis*

Drawn up by F. C. Flint, A. R. Payne, G. E. F. Lundell, C. Reed, C. A. Walworth, K. C. Sanders, D. D. Schurtz.

PREPARATION OF SAMPLE. The sample is washed with distilled water, and dried thoroughly. It is then chipped into an agate mortar and ground to pass 200-mesh, placed in a clean bottle and tightly stoppered as it is hygroscopic.

FUSION OF THE SAMPLE. If the sample is fused immediately no ignition is necessary, otherwise the ignition must be run and the analysis calculated back to the moisture free basis.

A one gram portion of the sample is mixed with 5 grams of sodium carbonate in a platinum crucible of 30-40 cc. capacity.

SILICA. The fused mass is transferred to a platinum dish[1], porcelain casserole or Pyrex beaker with heat water, making sure that the transfer is complete. Cover with a watch glass and place on the steam bath till disintegration is complete. Add hydrochloric acid in excess, being careful that the reaction is not too violent and that the dish is well covered. Evaporate to dryness, moisten the mass with HCl 1:1 and add some hot water. Digest on a steam bath for ten minutes and decant through a filter. Add 50 cc. hot 1 per cent HCl, break up any large lumps with a blunt stirring rod and decant again. Transfer the precipitate to the filter, police the beaker with hot 1 per cent HCl and wash the precipitate four times with hot H_2O.

Evaporate the filtrate to dryness on the steam bath and bake at not more than 110 deg. C. for 1 hour to dehydrate the silica. Moisten the dry mass with hot HCl 1 per cent and add 50 cc. hot H_2O. Digest on the steam bath for 10 minutes and filter into a 400 cc. beaker. Police the beaker with hot HCl 1 per cent and wash the precipitate four times with hot H_2O.

Place the combined precipitates in a platinum crucible, dry thoroughly and burn off the papers without allowing to burst into flame. Blast for 15 minutes at 1200 deg. C. Weigh and blast again at 1200 deg. C. to constant weight. Moisten the contents of the crucible with H_2O, add 3 drops H_2SO_4 and fill the crucible with HF. Evaporate to dryness and blast for a few minutes at 1200 deg. C. The loss in weight is SiO_2. Report as SiO_2.

Fuse the residue left in the crucible with Na_2CO_3 and add to the filtrate.

IRON AND ALUMINUM. The combined filtrates from the silica are adjusted to a volume of approximately 200 cc., one drop of HNO_3 is added as an oxidizing agent. The solution is then brought to a boil and a few drops of methyl red indicator added. Ammonium hydroxide is now added drop by drop till the solution turns distinctly yellow. The solution is boiled for 3 or 4 minutes and the precipitate allowed to settle.

Transfer the precipitate to the filter with hot NH_4NO_3 2 per cent. Police the beaker and wash the precipitate with hot NH_4NO_3 2 per cent till free from chlorides. The precipitate is ignited while moist in a platinum crucible and weighed as the combined oxides of iron and alumina.

If it is desired to separate the two, the ignited residue is fused with 2 grams of fused $KHSO_4$. The fusion cake is dissolved in hot H_2O, 5 cc. concentrated H_2SO_4 added and the iron reduced with H_2S and titrated with standard permanganate solution.

The oxide of alumina is obtained by difference. In the ordinary analysis this separation is not carried out.

TiO_2 may be determined before or after the Fe_2O_3 determination by the colorimetric method and also subtracted from the alumina.

LIME. The filtrate from the iron and alumina determination is made slightly ammoniacal. The solution is brought to a boil and 25 cc. saturated solution of ammonium oxalate added. Boil for ten or fifteen minutes and allow the precipitate to settle. Filter through a small filter paper. Police the beaker and wash the precipitate 5 times with $(NH_4)_2C_2O_4$ 1.5 per cent. Then wash once with hot H_2O to remove the excess $(NH_4)_2C_2O_4$. The precipitate is then washed into a beaker with hot H_2O through the punctured filter paper and dissolved in an excess of 25 per cent

*Method of analyzing soda-lime glass as outlined and adopted by the Glass Division Committee on Standards, American Ceramic Society.

[1] Silver dishes lined with platinum are now available for silica determinations at a cost of about $40.

RESULTS OF ANALYSES OF STANDARD GLASS SENT OUT BY THE GLASS DIVISION, STANDARDS COMMITTEE, AMERICAN CERAMIC SOCIETY

(The analyses have been made by the methods in use at the laboratories to which samples have been submitted)

Analyst	SiO_2	Fe_2O_3	Al_2O_3	Total R_2O_3	CaO	MgO	Na_2O	K_2O	SO_4
Soc. Glass Technology	73.93	0.06	0.38	0.44	4.85	3.18	17.54	N.D.[2]	N.D.
Bureau of Standards	73.96	0.07	0.31	0.44	4.80	3.15	16.86	0.04	N. D.
1	74.19	N. D.	N. D.	0.51	4.76	3.36	17.25	N. D.	N. D.
2	73.61	0.068	0.79	0.858	4.90	3.55	17.12	N. D.	N. D.
3	74.11	N. D.	N. D.	0.53	4.87	2.07	N. D.	N. D.	N. D.
4	74.34	N. D.	N. D.	0.96	5.48	3.46	N. D.	N. D.	N. D.
5	73.87	0.09	1.07	1.16	4.76	3.15	N. D.	N. D.	N. D.
6	74.10	N. D.	N. D.	0.68	4.97	3.54	16.53	N. D.	N. D.
7	73.84	0.10	1.00	1.10	7.02	N. D.	17.20	N. D.	N. D.
8	73.61	N. D.	N. D.	0.50	4.76	3.41	17.64	N. D.	N. D.
9	74.10	N. D.	N. D.	0.44	4.51	3.43	N. D.	N. D.	N. D.
10	74.50	0.081	0.45	0.531	4.60	3.24	16.50	N. D.	0.48
11	73.73	0.102	0.315	0.417	5.53	2.827	17.156	N. D.	N. D.
12	73.32	N. D.	N. D.	0.81	4.75	3.52	17.60	N. D.	N. D.
13	73.23	0.19	0.56	0.75	5.17	3.59	16.27	0.59	N. D.
14	73.97	N. D.	N. D.	0.41	4.77	3.22	16.41	N. D.	N. D.
15	74.25	0.19	0.22	0.41	4.84	3.49	17.27	N. D.	N. D.
16	74.88	N. D.	N. D.	0.76	5.45	3.05	15.71	N. D.	N. D.
17	73.52	N. D.	N. D.	0.55	5.10	3.33	N. D.	N. D.	N. D.
18	73.27	N. D.	N. D.	0.48	5.09	3.46	N. D.	N. D.	N. D.
19	73.81	0.08	0.42	0.50	4.81	3.10	N. D.	N. D.	N. D.
20	74.78	0.06	0.36	0.42	5.52	3.56	15.73	0.09	N. D.
21	74.7	0.23	0.60	0.83	4.90	3.20	16.70	N. D.	N. D.
22	73.79	0.15	0.63	0.78	4.73	3.19	16.58	0.06	0.49

[2] N. D. not determined.

H_2SO_4. The solution is made up to 75 cc. with hot H_2O and is titrated with standard potassium permanganate to the first permanent faint pink color. The filter paper is placed on the inside of the beaker near the top and added to the solution near the end point. The calcium is calculated to CaO.

MAGNESIA. The filtrate from the lime is made slightly acid with HCl and brought to a boil. The volume may range upward to 600 cc. One-half gram of microcosmic salt is added and the solution stirred thoroughly. One-ninth of the total volume of ammonium hydroxide is added, the solution stirred vigorously and allowed to stand before filtering. Frequent stirring and cooling will hasten the precipitation. The precipitate is filtered through a Gooch filter. Police the beaker and wash the precipitate with 5 per cent NH_4OH. Dry before igniting. Ignite to constant weight at 1200 deg. C. Calculate to MgO by using the factor .3621.

For greater accuracy the magnesia may be filtered through a filter paper, dissolved and reprecipitated.

ALKALIS. In most routine analysis the alkalis are determined by difference. This throws all the error on the alkalis. If a more accurate method is desired, the J. Lawrence Smith fusion method is recommended.

Some Aspects of American Glass Tank Furnace Practice

BY FRED S. THOMPSON, TOLEDO, O.

In October of last year we prepared and mailed to the glass manufacturers of Canada and the United States a questionnaire dealing with some of the features of glass tank operation. As stated in our letter, attached to each questionnaire, it was not our intention or desire to pry into any confidential details of individual practice, but to gather such information as the manufacturer is willing to give in order to promote thought and discussion on a problem which we believe to be of first importance.

One hundred and forty letters were sent out, which netted twenty-seven complete replies. In addition we received twenty-two replies stating no tanks were used and one point-blank refusal to answer any questions. In all we received fifty responses.

Since this report is intended to be a summary of the information thus secured, it seems logical to consider the matter question by question in turn.

QUESTION No. 1

Do you have a regular schedule for heating up your tanks, to which you adhere?

This question was asked separately and in a form requiring an answer of "Yes" or "No" more for its effect than for any information it might bring in. It tends to emphasize the fact that there might be such a thing as regularity or system in a process that is governed largely by rule of thumb methods.

The replies were as follows:

Yes	21
No	3
No definite schedule	3

QUESTION No. 2

How many days are required for this schedule?

This question brought a greater variety of answers than any other one in the list. The number of days required ranged from a minimum of 7 to a maximum of 28, with most of the intermediate figures represented. One figure of six days is shown, but this applied to day tanks.

The replies were as follows:

Six days	1	(day tanks)
Six to seven days	1	
Seven days	1	
Ten days	4	
Eleven days	1	
Ten to fourteen days	2	
Twelve days	2	
Twelve to fifteen days	1	
Fourteen days	3	
Fourteen to eighteen days	1	
Nineteen days	1	
Twenty-one days	5	
Twenty-five days	1	
Twenty-seven days	1	
Twenty-eight days	1	

A glance at these figures gives us the immediate impression of a wonderful lack of uniformity. If twenty-one days is the proper length of time, it follows that there are a great many furnaces being severely abused. If six or seven or ten or fourteen days are correct, it just as certainly follows that many manufacturers are wasting many days of valuable production. It is apparent that this is a phase of furnace practice that needs more investigation and standardization.

QUESTION No. 3

What points in the temperature curve do you consider the most critical?

With this question we intend to establish, whether or not, in the opinion of furnace operators, there are points in the rise of temperature that are accompanied by any marked increase in the rate of physical change of the refractories in the furnace. We know that physical changes do take place in the silica brick and that the rate of these changes is not proportional to the rate of rise of temperature. In other words, we have all observed that the silica crown expansion is much more rapid at some points than others. Our lack of success in establishing the identity of these points is well illustrated by the figures in the replies.

Of course, we realize that the "behavior" curve of silica brick has been studied and their performance at all points of temperature noted. However, the temperature-performance of a silica arch (exposed to atmospheric conditions on one side, and rising temperature on the other) is not very well known. Although we may know what to expect in a silica brick at a given temperature, when uniformly heated, we do not know when it arrives at a condition equivalent to this temperature when it is in an arch, crown, or cap.

The general practice among furnacemen for taking care of arch expansion is to "let out" on the tie-rods as their judgment dictates. Until we have more definite knowledge than is indicated in the replies to the third question, it would be useless to recommend anything more specific.

Summarizing the viewpoints of our various respondents, we find their conceptions of the most critical points in the heating curve vary from "watersmoking" on the one extreme to "1,500° F. to 2,200° F." on the other.

Analysis of the figures shows that the span from 700° F. to 1,000° F. has received the highest number of votes as most critical point.

The minimum danger point seems to be at top heat where we have but one vote which reads "from 1,400° F. up." Other low points are 0° F. to 200° F., 1,200° F. to 1,400° F., and 1,800° F. to 2,200° F.

Although the several opinions seem to vary all over the scale, the bulk of sentiment favored the lower half of the scale and the greatest concentration is between 600° F. and 1,200° F.

QUESTIONS NOS. 4 AND 5

Where are the initial fires applied in the cold furnace? and What fuel is used?

The replies to this question can be summarized under three general heads, as follows:

(1) Fires in tunnels at base of checkers.
Eleven use this method, of whom five burn natural gas, three fuel oil, and three wood.

(2) Burners at ports.
Three use this method, two with natural gas and one with oil.

(3) Perforated pipe burners within tank.
Seven use this method with natural gas as the initial fuel.

The other seven use modifications of the above or are indefinite or non-committal in their answers.

QUESTION No. 6

Do you warm up the tanks empty or with cullet?

Nineteen replies signify the use of cullet, seven, the total absence of cullet.

QUESTION No. 7

What is the depth and manner of distribution of the cullet?

To this question there were no two replies exactly alike. On the whole, however, the bulk of replies can be grouped under three heads, as follows: (1) "Heaping full"; (2) Partly filled and banked against side walls, and (3) Bottom covered sufficiently to seal throat. Differing from these were the two methods of distribution shown in Figs. 1 and 2.

Although widely practiced there has always been a difference of opinion as to the advisability of warming up a tank filled, or partly filled, with cullet.

The principal reasons generally advanced for its use are: (1)

To glaze the flux walls and bottom, (2) To save time in charging, (3) To act as an insulator or protector for the walls against a too rapid rise of temperature or sudden jumps of temperature.

The first object can be accomplished just as effectively after the tank is heated. We are inclined to doubt efficacy of glazing tank walls by heaping cullet against them. The second object (saving time) is one that can be gauged with a fair degree of accuracy, but the question arises as to whether or not these few hours or days might be gained at the expense of weeks on the life of the

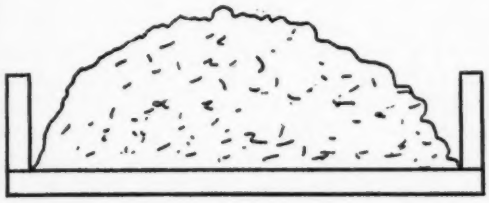


FIG. 1

tank. Tank blocks are usually burned at a temperature that is from 100 to 200 Fahrenheit degrees less than that which usually obtains in a glass furnace. We know from repeated trials that when a block is burned to 2,650° F. that its porosity is reduced from the usual twenty-six or twenty-seven per cent to eighteen

FIG. 2

to twenty per cent. Most glass men agree that the higher burned tank block gives longer and better service than the lower burned ones. Needless to say, however, that higher burned tank blocks cannot be sold for sixty dollars per ton. Nevertheless the inside face of the flux walls and bottom can be subjected to the full heat of the furnace at the end of the warming up period if the cullet be kept out or if a small amount of cullet be used, as shown in Fig. 2.

A Method for Measuring the Softening Temperature of Glasses

BY J. T. LITTLETON, JR., CORNING, N. Y.

Uniformity of product is desired in the glass industry where the articles are made on automatic machines and may be later

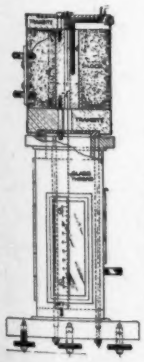


FIG. 1

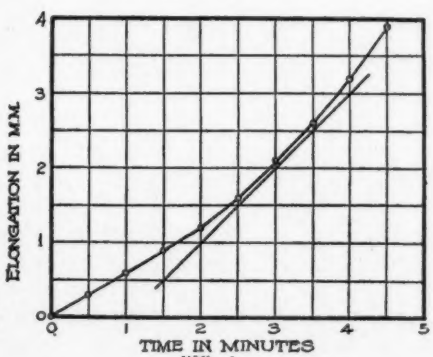


FIG. 2

subjected to a second automatic operation. In order to obtain the desired degree of uniformity, some method of measurement is necessary for the control of the batch. The property of the material measured for control purposes should be a property which affects the operation of the machine. The requirements of a control method are that it shall be sufficiently simple so that a number of measurements can be made, and the measurements shall have a sensitivity sufficient to detect any variations before any change is noticeable in the ware or in the fabrication of the ware. The property of the glass which most directly affects the operation of the automatic machines is the viscosity. The timing of the machine is adjusted for a certain viscosity and it is necessary for this property to remain constant in order that the machine function uniformly. In operation constant viscosity is sought by means of temperature control. This assumes that the glass remains constant in composition.

The following is a description of the method which has been used at the Corning Glass Works for a number of years as a control of the composition. The method consists in measuring the temperature of the glass at which it has a certain viscosity, which temperature is called the softening point of the glass. It is believed that in addition to serving as a method for control it further furnishes a point of reference to indicate difference between different glasses of different composition in regard to viscosity.

The softening point of glass may be defined as that temperature at which a uniform thread of glass of standard length (22.9 cm) elongates under its own weight at the rate of one millimeter per minute when suspended in a furnace. It is evident that this method gives only an approximately accurate comparison between glasses of widely different composition since surface tension and specific gravity both enter to affect the force tending to elongate the specimen.

A uniform thread of glass about 1 mm. in diameter, 22.9 cm. long is worked to this shape in a flame avoiding crystallization or reduction. This thread is suspended from one end in the electric furnace shown in the drawing at a temperature from 50 to 100 deg. C. below the softening point of the glass. The furnace temperature is then raised at a rate of 5 to 10 deg. C. per minute.

The position of the end of the glass thread is noted on the millimeter scale every thirty seconds. Immediately after noting the position of the point the temperature of the furnace as indicated by the thermocouple mounted with its junction at the center of the furnace is read. A curve is plotted between time and position of the point on the scale, using ten divisions on the paper for 1 mm. on the scale and ten divisions on the paper for one minute. Hence the tangent to the curve having a 45 deg. slope will indicate that point on the curve at which the rod is elongating at the rate of 1 mm. per minute. Comparison of the time at which the glass was elongating at this rate with the temperature-time observations will then give the temperature required to give this degree of softness. Such a curve obtained in such a manner is given in Fig. 2 and the data from which the curve is obtained is found in the table.

TABLE I

Time Min. Sec.	Temperature Deg. C	Elongation mm
0 :00		0:0
15	680	
30		0.3
45	682	
1 :00		0.6
1 15	684	
1 30		0.9
1 45	686	
2 :00		1.2
2 15	688	
2 30		1.6
2 45	690	
3 :00		2.1
3 15	692	
3 30		2.6
3 45	695	
4 :00		3.2
4 15	697	
4 30		3.9

Softening point, 691 deg. C.

The position of the point may be noted by means of a telescope or by means of a reflector mounted back of this scale, either of these means will serve to avoid parallax. Measurements repeated on the same glass should be reproducible to within at least 2 deg. C. and with care a 1 deg. C. accuracy can be attained.

Development of Plate Glass Pot Filling Processes

Mechanical Methods Forced on Industry by Labor Conditions

By J. W. Cruikshank*

In the plate glass industry the filling of the pots in the furnaces has long been a problem which was difficult to solve. Formerly when labor conditions were such that men could be obtained at a low rate of wages and could be relied upon to continue to work at arduous jobs, there was not the pressing need of machinery that has developed under modern conditions. Under present economical conditions it is necessary to substitute machinery for manual labor even though the upkeep and investment in dollars and cents may more than offset the cost of labor when the work is done by hand.

Operations such as filling furnaces, where a labor gang is employed, must not be dependent on the temperament of the men who may have some grievance, real or imaginary, and may quit their job at a critical time, not only stopping production of the glass plant, but also thereby causing damage to the pots by suspending operations at an incpportune time.

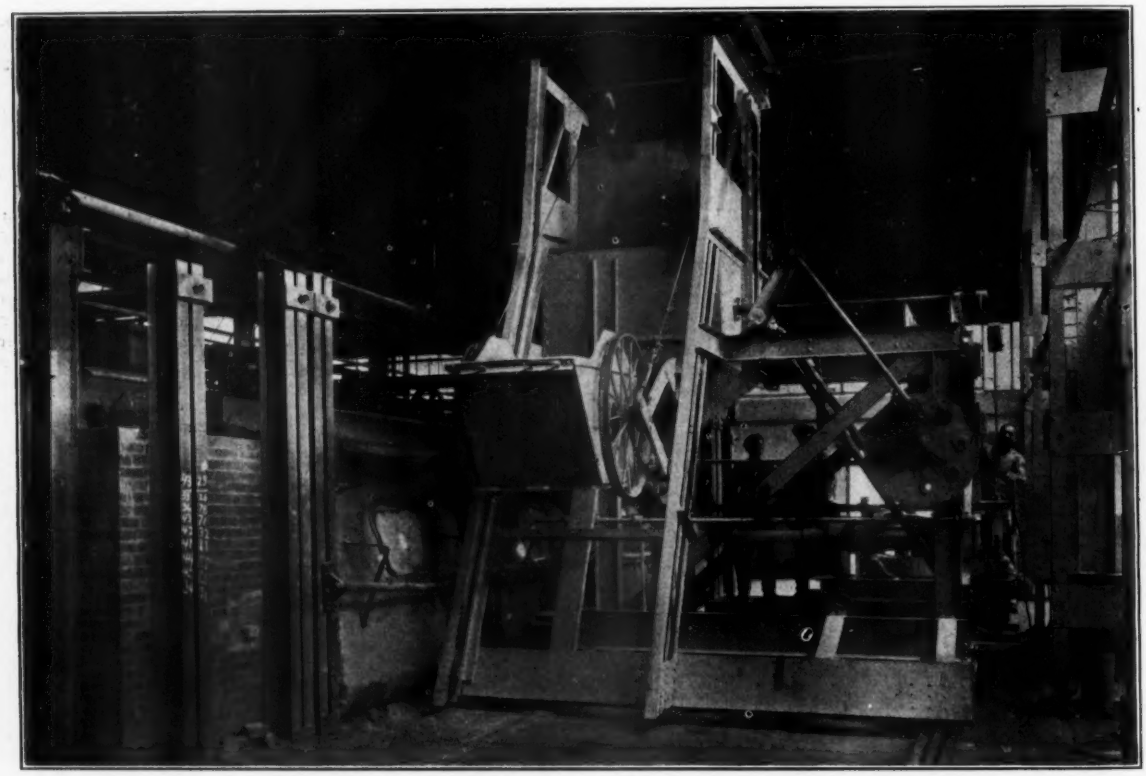


PLATE GLASS POT FILLING MACHINE, SKIP CAR TYPE

Filling pots in a plate glass furnace by hand is a most strenuous task, which when replaced by mechanical means, may be said to be a boon to labor. The manual operation is performed by pushing the batch in the ladle through an opening in the furnace into the pot. Two-wheeled wagons are employed holding about 1500 lbs. of batch, which the men push into the furnace hall and place in a convenient position nearly opposite to the pot to be filled. The furnace usually contains twenty pots, two in each of the five arches on each side of the furnace, thus five of these wagons are required which are placed at convenient points just between the openings. The actual filling of each pot takes three men, one man uses a ladle which consists of a light sheet iron box mounted on the end of a rod 18 ft. long. This ladle is placed by him on the floor close to the pile of batch, which has partly flowed out of the wagon nearest to him, from which it is filled by two men with shovels from this pile of batch. As soon as the ladle is filled the filler raises it up, throws the ladle handle on a supporting bar that is placed across the face of the furnace, slides the ladle into the furnace over the pot, and then turns it over so that the contents are dumped. He then pulls it out, places it on the floor to be filled as before, ready for the operation to be repeated. The job is a very arduous one for the three men, not only on account of the heat from the furnaces and the hard manual labor, but on account of the soda ash dust that flies up from the shoveling and spills from the ladle. The filling gang consists of ten to twelve men who work on both sides of the furnace at the same time.

Modifications in the above described process of filling pots have been devised to aid the men and render the operation

* J. W. Cruikshank Engineering Co., Pittsburgh, Pa.

less arduous. In the European factories they use a rail above and projecting out from the face of the furnace. On this is mounted a trolley to which the ladle rod is attached near its center. This takes the weight of the rod and ladle and is a great aid to the workmen in the filling operation. This arrangement, however, cannot be used in American factories on account of the method of removing pots from the furnaces with an overhead crane. A similar device has been installed by which a framework, carrying the rails, is mounted on rails on top of the furnaces. This is moved along opposite to each hole as required. For the purpose of raising the ladle an air cylinder, mounted on a trolley, is suspended from the projecting beam, to the depending piston rod of which the ladle rod is attached. When the ladle is filled, it is raised by means of the air pressure to a position opposite the hole, and pushed into the furnace by the operator. This device works fairly well and somewhat ameliorates the labor of filling.

The first fill is put on about an hour after the cast, when the pots are brought up to the temperature for filling. The second fill is put on some six hours later when the batch material is melted down in the pots, and the third fill is a small quantity of material, generally cullet, which is filled into the pots about four hours after the second fill and before the finish. The third fill takes little time as a small quantity of material is used. It is evident that it is uneconomical to keep men around for such a small operation as the third fill, and for that reason the machine has a great advantage, in

FILLING BY HAND

One man uses a ladle which consists of a light sheet iron box mounted on the end of a rod 18 ft. long which is filled by two men with shovels.

that it is there, and easily operated by one man for any additional fills that may be required, at any time during the melting operation. In different factories the organization varies with the number of furnaces run. In case of a continuous casting operation where the furnaces are cast night and day the inconvenience of the third fill does not occur as the men are always there, but in comparatively small factories that have, for example, three furnaces some of the filling gang have to be kept on. In case of the small factory operation the casting hall gang generally takes care of the first fill, being augmented sufficiently for that purpose, and a second gang of six men is employed to put on the second fill. With the use of machines the labor is much reduced. The first fill, with two men operating the machines and two helpers, requires four men; for the second fill only two men are necessary; and the third fill can be readily handled by one man

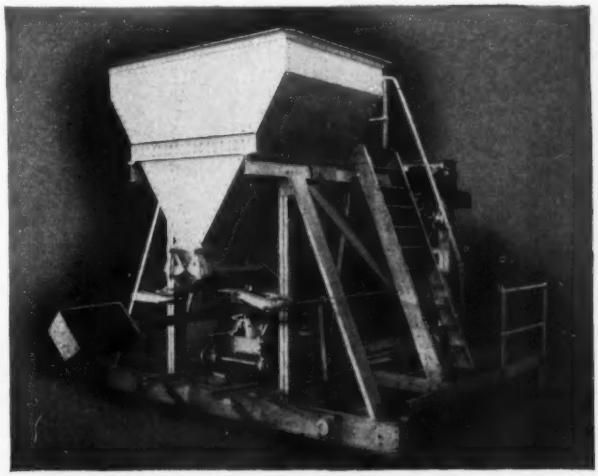


PLATE GLASS POT FILLING MACHINE

who puts the required material in the pots. Moreover the machines are available at any time for putting a small quantity of cullet in any of the pots should it be found advisable.

The filling operation as above described cannot be compared with the familiar one of supplying the batch material to a continuous melting tank which is relatively simple. In this case the batch is all brought to one point and filled into the furnace by means of a large ladle mechanically operated and controlled by one man who also attends to the conveyors that bring the materials from the batch house. In the manufacture of plate glass an operation of this kind is not possible as the pots are located at various points in the furnace hall. The conditions for the filling of a tank are also more favorable in that the body of metal in the melting chamber is large and the unmixing of the batch will not have as serious results as it would in the individual pots.

It is essential that the pots should be filled individually and gradually so as not to cool them down too much and the dumping of a large quantity of material into a pot after it has been heated up in the furnace, chills it. Various other methods of filling have been tried, for example, that of removing the pot from the furnace and flowing the material out of a chute from a bin that is located at the side of the furnace hall. This method was found to be impracticable, resulting in the chilling of the pot partly from its removal from the furnace and partly from the dumping of a quantity of cold material into it suddenly. This is further accentuated in the second fill when the clay of the pot becomes too soft from the high temperature of the furnace to allow the pot to be handled with immunity by the tongs. Other schemes have been tried, notably that of placing a chute through a hole in the top of the furnace over the pot and supplying all the batch material through it. Another scheme which was worked for

some time was that of feeding the batch material from a bin through a water-cooled nozzle by means of a screw. This has worked fairly satisfactorily, but trouble with the cooling water and the tendency of the conveyor to choke caused its abandonment.

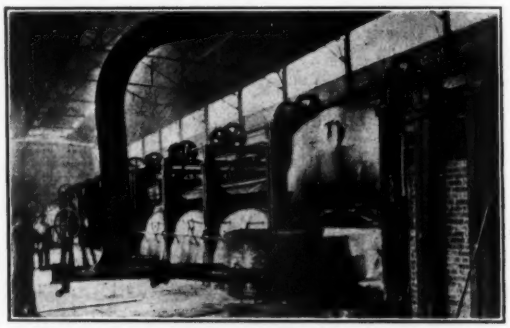
The old and new methods of filling pots in a plate glass factory may be compared with that of removing them from the furnace with the pot wagon tongs, and the overhead crane. The hand method required some ten men from the casting hall gang who used their weight as a counter balance, in comparison with the method used today of removing the pots with the overhead crane which requires one man in the crane cage and one man to guide the crane pot tongs.

An illustration of a filling machine was shown in our issue of January. This machine is of the type where the batch is dumped into the top of the bin from a hopper which is lifted by means of the overhead traveling crane in the furnace hall. There are two divisions in the bin, one of them contains glass batch and the other cullet, either of which can be fed to the filling ladle at the will of the operator. There is another type of filling machine illustrated in Fig. 1, in which an ordinary batch wagon is placed on a skip car frame, which by means of an electrically operated hoist raises it and dumps it into the bin, there being a valved division at the top which guides the batch or cullet into its respective compartment as the case may be. Fig. 2 shows a machine of the first type set up on the floor viewed from the ladle end.

The machine is arranged to run on rails on the furnace hall floor. It is actuated by an electric motor and thus takes its position in front of an arch in which the pots have to be filled. The ladle is swivelled on a trolley and is so controlled that it will swing over to the left hand pot when it is desired to fill that pot. By reversing a switch the ladle will swing over the pot on the right hand side of the arch, thus both pots in the arch are filled without moving the machine. The ladle moves in and out of the furnace by the movement of the trolley carriage, which is actuated by an arm connected to the mechanism above. As the ladle goes in through the hole in the furnace tuile, there is a rising movement so as to pass over the top of the pot, as well as the horizontal swinging movement. After it has arrived at the proper location for dumping, the ladle is turned over, and on the reverse outstroke comes out upside down. This is an important development as otherwise the ladle in coming out may gather up small pieces of clay or other foreign matter from the tuile. As soon as it arrives under the bin gates it reverses ready to receive its charge, which is given by the operator pulling one of the levers operating the gates for either batch or cullet.

The machine is equipped with electric control furnished by Cutler-Hammer which renders it perfectly automatic in its action with acceleration and slow down to suit the conditions involved. The operator, after filling the ladle from the bin, starts it in toward the furnace. It passes through the hole and swings over to the pot that it is desired to fill, where it turns over and dumps the material. Toward the end of the instroke there is a gradual slowing down of the ladle so as to prevent shock to the mechanism. After the ladle is dumped it starts to return with a gradual acceleration of speed, and a slowing down which brings it under the bin hopper ready to be filled. Here it remains for about three seconds, giving the operator time to charge it when it again starts off to re-enter the furnace and deliver its charge to the pot. The total time of the cycle from filling to dumping and return is eleven seconds, with the ladle holding about 200 lbs. of batch.

GANG REMOVING POT FROM FURNACE WITH POT WAGON



REMOVING POT FROM FURNACE WITH CRANE

The hand method required some ten men from the casting hall gang who used their weight as a counter balance, in comparison with the method used today of removing the pots with the overhead crane which requires one man in the crane cage and one man to guide the crane pot tongs.

The Cruikshank Engineering Company have furnished several of these machines which are in operation, notably for the new plant of the National Plate Glass Company at Ottawa, Ill.; the Ford Motor Company, formerly the Allegheny Plate Glass Company, at Glassmere, Pa., and two machines are now being built for the Springdale plant of the Standard Plate Glass Company.

To Study the Industrial Uses of Gas

The American Gas Association is devoting half a million dollars to carrying out a research program for the development of the industrial and factory uses of gas. Several investigations have already been started including one relating to brass melting furnaces and another in the bakery field.

It is intended to extend the work to the ceramic field, among others, including food stuffs, non-ferrous metals, forgings, heat treating, drying, and miscellaneous heat operations. The work will be conducted along research and development lines.

Tank Block Endurance

By S. R. Scholes*

Recent developments in the art of making walls for the retention of molten glass have brought forth tank blocks which seem certain to establish new standards of longevity. The announcement of these blocks has aroused new interest in the subject of tank blocks. The purpose of this article is to recite the principles underlying tank block corrosion, and to point out the reasons for expecting greatly improving performance from the mullite blocks.

As the chemist looks over the entire field of available elements, in his search for the final choice of material for tank blocks, he is impressed by the fact that all oxides are soluble in glass. The most refractory of the common oxides—alumina, silica, lime and magnesia, are also found as important ingredients of glass. Even zirconia, whose rarity alone prevents it from becoming a useful refractory, can be incorporated in the batch and form part of the glass itself.

Thus it becomes apparent that no such thing as a wall indifferent, or absolutely resistant, to molten glass, can be made from any combination of earths. A few binary compounds, not oxides, have been synthesized, which are refractory. The attack of oxygen at high temperatures, however, and often the action of casual water or water-vapor at ordinary temperatures, is enough to decompose these compounds, leaving little to be hoped for from such sources.

Meanwhile it must always be borne in mind that although the tank block problem is a serious one, the economic loss resulting from tank block corrosion is not so stupendous that it would justify unlimited expenditure for its prevention. For this reason, the principal urge to improvement has remained the one of competition among manufacturers of blocks, and progress has been relatively slow.

The traditional and until now the only wall in general use retaining glass has been made of clay. Natural sandstones have found local use, and perhaps other rocks, but none of these have reached importance. The tank block of yesterday and today is a large fire brick, made of clays selected under the rule of trial and error.

This clay body is formed from a mixture of plastic fire clay and a grog consisting of ground burnt fire clay. It is composed chiefly of silica and alumina, in the proportion of kaolinite,—$Al_2O_3.2SiO_2$—with an excess of silica. Upon drying, the block becomes porous, and the porosity only partly lessens upon burning.

The strength of this burnt clay body depends upon the partial fusion or sintering of the more fusible minerals present as impurities in the clay. These are principally feldspars and other minerals containing alkalies, iron, and lime. Clay-substance by itself cannot develop a strong bond at usual kiln temperatures, and tank blocks would be too weak and friable for use, without the cementing effect of these fusible minerals.

At the temperature of the glass furnace, the tank block consists of refractory particles, held in a magma of more or less glassy material. Slow reactions take place, and the least fusible and most insoluble crystalline compounds form, to an extent limited by the alumina-silica ratio of the body, the temperature reached, and the amount of solvent flux present.

Bowen and Greig, in 1924, made a thorough study of the alumina-silica system at high temperatures. They demonstrated that above 1,400 deg. C. (2520 deg. F.), the compounds existing are: pure silica as crystobalite, melting a little above 1700 deg. C.; pure alumina as corundum, melting at 2050 deg. C.; and one compound of the two, having the formula $3Al_2O_3.2SiO_2$, which is called mullite. This compound contains 72 per cent alumina, and melts at 1810 deg. C.

The significance of their work for the study of refractories is very great. It has taught us that in clay bodies containing less than 72 per cent alumina,—and this comprises virtually all of them—crystoballite and mullite are the ultimate compounds to form, surrounded, as mentioned above, by small amounts of more or less liquid material. However, it must be remarked that the crystallization of these compounds from the amorphous clay takes place very slowly at the glass furnace temperatures, and would be incomplete at the end of the life of a tank block.

This work also teaches that highly heated mixtures of clay and aluminous minerals such as diaspore, containing more than 72 per cent alumina, contain as end-products of crystallization only mullite and corundum.

Therefore if a mixture is chosen containing 72 per cent alumina and 28 per cent silica, and fused at a high temperature, and then cast, the resulting mass is practically crystallized mullite. It is free from low-melting bonding material, non-porous, and infusible at any glass furnace temperature. In these four properties lies its superiority as a wall against molten glass.

It is an established fact of physical chemistry that the stable crystalline form of any compound is less fusible, more resistant to chemical change, and less soluble than the amorphous or glassy form. Thus it is to be expected that greater resistance to the attack of molten glass would be offered by a crystalline body than by an amorphous or glassy one.

The low-melting bonding material of a clay tank block is readily brought into complete fusion and dissolved in contact with molten glass. The mullite body, consisting entirely of high-melting material, is not subject to this form of attack. Moreover, the addition of such a substance as feldspar to a glass, as by solution from the surface of a tank block, cannot add greatly to the viscosity of the resulting solution. It, therefore becomes fluid and is easily washed away in the main body of the glass. The dissolving in glass of material high in alumina, on the other hand, will not only be much slower because of its high melting point, but the solution is more viscous, and more difficult to remove from its protecting position on the block surface.

*Federal Glass Co., Columbus, O.

The presence of pores in a tank block is a recognized fault, unavoidable as it is in a clay block. It permits the penetration of the liquid glass, and attack on the refractory particles from all sides. The absence of pores in the mullite blocks is therefore a most important advantage.

Outstanding among the characteristics of the mullite block is its high fusion temperature. So long as we deal with a clay block which will soften within 200 deg. of the glass-melting temperature, and melt at 3,100 deg. F., it is to be expected that contact with white-hot glass will steadily bring it into solution. But with this new product, remaining rigid through a range of temperatures sufficient to soften and fuse clay, and remaining unmelted up to nearly 3,300 deg. F., no doubt of its endurance against glass can be maintained.

To say that mullite, cast or bonded or synthetic, is the ultimate tank block material, would be idle. The rate of inventive progress is so rapid that someone may soon find an economical means, for example, of casting a block of the still more refractory corundum, and thus bring about a further revision of our estimates of possible tank block life.

Aluminum Hydroxide for the Manufacture of Opaque Glass

By Robert Schneider*

In the manufacture of opaque glass it is necessary to supply enough alumina (Al_2O_3) to bring the amount in the finished glass up to at least three per cent. Unless this is done, it is impossible to obtain a dense, milk-white effect.

A real opaque glass cannot be made with fluorspar or with sodium silicofluoride alone. If the use of the expensive cryolite is to be avoided (the cost of the natural and the synthetic cryolite is about equal), it is necessary to add, in addition to fluorspar and sodium silicofluoride, a material containing alumina. Usually feldspar or kaolin are recommended for this purpose. However, they usually have the disadvantage of being of a high iron content, causing the opaque glass to show a faint greenish color. If the danger of a greenish looking glass is to be avoided, it is necessary to carry on the melting process under strongly oxidizing conditions in order to transform the green coloring bivalent iron to the trivalent form. For this purpose it is necessary to use more or less considerable amounts of saltpetre. The cost of the latter material, however, nullifies the saving due to the use of minerals high in alumina.

Aluminum hydroxide is especially adapted to the manufacture of opaque glasses, on account of its freedom from iron. At the present time it is possible to obtain a material in commerce which contains only 0.002 per cent if iron oxide.

Alumina occurs in the hydrated form as bauxite, having the formula $Al_2O_3.2H_2O$. This mineral however is not pure enough to admit of direct use in glass making, as it contains from one to thirty per cent of iron oxide. Aluminum hydroxide is usually prepared from bauxite, by first roasting the mineral at a low temperature to convert ferrous oxide to ferric oxide, and then heating it with sodium hydroxide solution under pressure. A solution of sodium aluminate is formed, which is decomposed by a stream of carbon dioxide gas, with the consequent precipitation of aluminum hydroxide:

$$2\,Na_2AlO_3 + 3\,CO_2 + 3\,H_2O = 2\,Al(OH)_3 + 3\,Na_2CO_3$$

Sodium Aluminate — Carbon Dioxide — Water — Aluminum Hydroxide — Sodium Carbonate

Other methods convert the bauxite into alum and subsequently to aluminum hydroxide.

It should be noted that aluminum hydroxide does not decrease the speed of melting and that no stony glass is formed, since the material is easily and completely soluble in the molten glass.

The following is a good batch for the manufacture of opal glass, using aluminum hydroxide. For purposes of comparison a batch without this material is also given.

	I	II
Sand	100	100
Feldspar	..	25
Kaolin	..	10
Aluminum hydroxide	**12**	..
Soda ash	20	22
Potash	8	12
Cryolite	6	8
Fluorspar	20	20
Saltpetre	..	4

If a specially dense glass is desired, for instance for illuminating glassware, it is advisable to add five parts of zinc oxide. The use of iron-free materials diminishes the absorption of light, since iron oxide, even in small quantities, very materially increases light absorption. This is an additional advantage of the use of aluminum hydroxide for the manufacture of opaque glassware.

It should be noted that neither kaolin nor hydrate of aluminum by themselves are opacifying materials. Without fluorine it is impossible to obtain opaque glass, when using either of these materials. English investigators have demonstrated that alumina itself does not play any part in the opacity produced. According to these scientists the microcrystalline particles which cause opacity are sodium fluoride and calcium fluoride, not aluminum fluoride or sodium-aluminum fluoride, as was previously believed.

Hydrate of aluminum has recently gained special significance through the invention of a method to produce opaque glass, covered by a French patent. (No. 471919.) In the year 1918, the American glass expert Alexander Silverman[1] found that sodium chloride (common salt) which cannot be used to introduce sodium into glass, can yet be of value to the glass industry. It was shown that small

* *Die Glashütte*, Vol. 56, No. 36 (September, 1926), 703-704. Translated for THE GLASS INDUSTRY.

[1] *Journal American Ceramic Society*, 1, (1918) 247.

[2] *Journal Society of Glass Technology*, 10 (1926), 199-212.

amounts of salt (about 3 parts to 100 parts of sand) when added to a batch for opaque glass, greatly increase the opacity and make possible a saving of materials containing fluorine. An interesting study of the effect of chlorides in opaque glasses has been published in the *Journal of the Society of Glass Technology*.[2] The French patent goes so far as to show the possibility of making opaque lead glasses by addition of a large amount of aluminum hydroxide and small quantities of salt, using only a very small quantity of fluorspar and no cryolite. This constitutes therefore an entirely new kind of opaque glass, which although fairly hard, can be easily blown, pressed and drawn.

In the patent the following batch is given:

Sand	100
Red lead	16
Fluorspar	6
Aluminum hydroxide	**18**
Soda ash	25
Saltpetre	2
Borax (crystallized)	2
Salt	5.5
	176.5

The glass made of this batch has the following composition:

	Per cent
Silica (SiO_2)	66.81
Alumina (Al_2O_3)	7.73
Boric acid (B_2O_3)	0.48
Sodium oxide (Na_2O)	10.38
Potassium oxide (K_2O)	0.62
Calcium oxide (CaO)	2.83
Lead oxide (PbO)	10.42
Fluorine (F_2)	1.27
	100.54
Deduct O_2 for F_2	0.53
	100.01

The fluorine content of this opaque glass amounts to only one-third to one-fourth part of the quantity usually occurring in glasses made with fluorspar and cryolite, on account of the larger quantity of alumina present, and due to the action of the salt. The importance of using such a small amount of fluorine with regard to its effect on the life of the pots is evident to every practical glass maker.

The glass made by this batch formula is purely white, having the appearance of porcelain. According to the claims made in the patent, the glass must contain both alumina and fluorine, but considerably more of the former than of the latter. At the same time the glass must contain a certain amount of chlorides, preferably as common salt, to about three per cent of the batch. The action of the chlorides is such that the whole glass is permeated with innumerable microscopic bubbles. They have an elongated shape, and are probably gaseous silicon fluoride, which has been formed during the melting of the glass and which was escaping from the molten metal. As is well known, a third of the fluorspar reacts with the sand in the following manner:

$$\underset{\text{Fluorspar}}{2CaF} + \underset{\text{Sand}}{SiO_2} = \underset{\text{Lime}}{2\ CaO} + \underset{\substack{\text{Silicon}\\\text{Fluoride}}}{SiF_4}$$

The remaining two-thirds stay in the glass as calcium fluoride. These bubbles of silicon fluoride disperse the light and opacity is the result of total reflection.

During the melting process it is of importance to guard against escape of the bubbles from the molten glass, that is, the temperature should not be too high, and the fining process must be made as short as possible. It is advisable to decrease the temperature of the glass furnace when it is evident that all of the sand has disappeared, but not until gas bubbles, visible to the naked eye, have left the molten glass. Since the glass is fairly hard, it does not burn out easily.

Conclusion

The usefulness of aluminum hydroxide for the manufacture of opaque glass has been demonstrated by several examples. The principal advantages are the following:

1. Possibility to obtain a dense opacity in the common fluorine containing batches.
2. The small iron content of the glass prevents too much light absorption and "low color" glass.
3. Opaque glass low in fluorine can be made, by the use of salt, which increases the life of the pot.

Since aluminum hydroxide can now be obtained in commerce at a reasonable cost, the use of this material for the manufacture of opaque glass is recommended.

Design of Parison Molds

In presenting a "Note on the Design of Parison Molds" at a meeting of the Society of Glass Technology a few weeks ago, Dr. S. English said that of the three molds, the ring, parison and blow molds, ordinarily used in the making of bottles by machines, the parison mold was by far the most difficult to design properly. There was only one feature of a parison mold that could be determined even approximately by a study of the finished bottle it was desired to reproduce, and that was its internal size or glass-holding capacity; but even in this respect allowance had to be made for the preliminary blow up which varied from one machine to another, and from one type of bottle to another. For the purpose of parison mold calculations it was convenient to use the volume occupied by 1 ounce of hot glass. Assuming that 1 ounce of glass at 1,250 deg. C. occupied ¾ of a cubic inch, a gob of glass to form a 24 ounce bottle should have a volume of 18 cubic inches. In regard to the shape of parison molds, the only feature which was recognized as essential, was the absence of sharp corners. The inner surfaces should always be continuous smooth curves.

The primary function of parison molds was to give a preliminary shaping to a quantity of glass, and the molds could only do this efficiently by cooling the glass surface in contact with the mold. It had been found that a heavy-walled mold always kept cooler than a light-walled mold under similar conditions. The thicker mold required less external cooling, and retained its good condition longer than the thinner one; but it was much heavier and in the case of a charge of molds it heated up to the proper working temperature so slowly that a considerable loss of output was entailed. Cast iron appeared to be perfectly satisfactory as a parison-mold material. It was suggested, however, that stainless steel parison molds might be tried in the case of small bottles.

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The Value of Standard Methods of Analysis

A study of the results obtained in various laboratories on the analysis of standard glass, reported elsewhere in this issue, is the strongest possible argument in favor of standardization of analytical methods. As will be remembered, the chairman of the Standards Committee, Glass Division, American Ceramic Society, sent carefully prepared samples of glass, of uniform composition, to a number of laboratories connected with glass factories or maintained by consulting glass technologists. The analyses were made according to the various methods in use at these laboratories. The work was done by men who are thoroughly experienced in analytical work, and who have specialized in silicate analysis. Yet the differences obtained are such as to make one doubt the value of analytical control. It is firmly believed that these discrepancies are not due to inaccuracy on the part of the analysts, but must be ascribed to lack of uniformity of procedure. It is, of course, advisable that the most accurate and the simplest procedure be selected as standard. But the first requirement for obtaining concordant results is uniformity of method. In proposing standard procedures of glass analysis, the Standards Committee has done an extremely valuable and necessary piece of work.

It is submitted that the Committee could even have gone a step further. For instance, it is not enough to recommend the J. Lawrence Smith method for the determination of the alkalies in glass. The method is quite long and rather complicated, and small differences in details may influence the ultimate result. In such a case it would seem profitable to describe every step of the procedure, so that there can be no misunderstanding whatever.

Every effort of the glass maker of today is bent toward producing homogeneous glass for the use of the machinery to which it is delivered, glass of a definite viscosity, of unchanging physical characteristics. These properties depend on various conditions, the most important being temperature and chemical composition. The modern viewpoint accepts the chemical analysis of glass as an important aid in obtaining the desired conditions, and every measure taken to insure speed and accuracy in chemical analysis is a step in advance toward the end in view. Success in metallurgy is generally recognized to depend largely on careful and constant control of raw materials and the intermediate and finished products. It is reasonable to assume that if the glass maker will be as careful of his temperature and analytical control as is the metallurgist, there will be less loss due to lack of homogeneity, changes in viscosity, devitrification, and other troubles which afflict the average glass factory.

Notable Installation of Stained Glass

Five stained glass panels, said to represent the highest achievement of American window design, have been made for St. Thomas's Church, Fifth Avenue and West Fifty-third Street, New York. They will be installed at Easter time. They are the work of Nicolas D'Ascenzo and have been fashioned after the glass in the cathedral at Chartres, France. The panels are the gift of an anonymous donor, said to be a woman.

SPECIMENS OF MODERN GLASSWARE IN THE EXHIBITION OF SWEDISH CONTEMPORARY DECORATIVE ARTS

On view temporarily at the Metropolitan Museum of Art, New York

In the south of Sweden, not far from the old city of Kalmar, is the site of the Orrefors Glass Works which has been in operation for more than two hundred years although it has only recently become known to the world at large. The plant was established in 1725, but the name of Orrefors did not begin to attain its present reputation until a decade ago when, in the years of 1915 and 1916, two clever young artists called Simon Gate and Edward Hald became affiliated with the company. Their arrival marked the beginning of a new era at Orrefors. It was as if the fires in the old furnaces suddenly revived under new draughts of fresh air. The modern Orrefors art glass was born. Ten years have passed, and now every Orrefors product is an individual piece of art, signed by one of the two originators.

There are four principal kinds of Orrefors glass, the beautifully colored Graal Glass, the engraved and the cut crystal glass, and finally the smoked glass which in the form of artistic household objects has come into extensive use, due, in part, to its comparatively low cost.

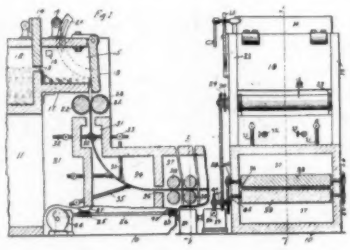
The examples illustrated above are: 1. Engraved Glass Vase, designed by Simon Gate. 2. Glass Covered Cup, designed by Edward Hald. 3. Carafe and Glass, designed by Edward Hald. 4. The Conservatory Vase and Dish. Engraved Glass, designed by Edward Hald. 5. Bowl, designed by Simon Gate. 6. Engraved Glass Bowl, designed by Simon Gate. 7. Glass Vase, designed by Edward Hald. 8. Glass Bottle, designed by Simon Gate. 9. Glass Plate, designed by Ewald Dahlskog and executed by A. B. Kosta Glasbruk.

Recent Patents

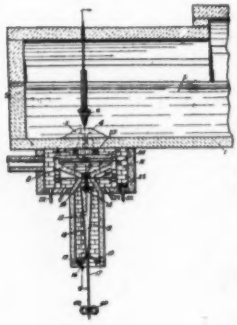
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

MACHINE AND METHOD FOR DRAWING GLASS. U. S. 1,616,405. Feb. 1, 1927. Clarence W. Avery, Detroit, Mich., assignor to Ford Motor Co. Filed 5/5/20. The method of producing a continuous glass sheet which consists in establishing a continuous flow of the molten glass, producing an embryo sheet formation in such flow-path, establishing a travel path for the embryo sheet with the path leading in a curved direction and maintaining the sheet free from support during its travel through such curved path to place the traveling sheet under complete and maximum gravity activity, subjecting such sheet to conditioning and polishing action within the zone of travel included in such curved path, and then leading the polished sheet in a substantially horizontal direction to the lehr.



RAY-FILTER GLASS. U. S. 1,615,448. Jan. 25, 1927. Isaiah Frank, Flushing, N. Y. Filed 7/6/25. A ray filtering glass which contains manganese dioxide neutralized by ferric oxide combined in such proportions that the filter is substantially colorless in commercial thicknesses and is capable of absorbing the greater portion of the ultra-violet and infra-red rays without appreciably reducing the normal high uniform transmission in the visible parts of the spectrum.

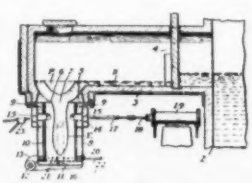


DRAWING SHEET CLASS. U. S. 1,618,107 Feb. 15, 1927. Joseph A. Reece, Toledo, O., assignor to The Libbey-Owens Sheet Glass Co. Filed 12/31/23.

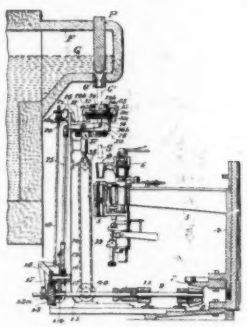
The object of this invention is to improve the methods of producing sheet glass. It comprises the method of making sheet glass, consisting in producing molten glass in a continuous tank furnace, flowing molten glass from the lower strata of glass in the tank into a separately inclosed pool, and flowing glass downwardly from the pool onto a slab from which it is drawn.

GLASS-MOLDING MACHINE. U. S. 1,616,308. Feb. 1, 1927. Victor Durand, Jr., Vineland, N. J. Filed 9/5/25. For molding towel-bars and the like in square, round, oblong and others cross-sectional forms. A mold adapted to receive the molten glass, a plunger for forcing it out, and a trough of the shape of the article to be formed, cut through which the glass is forced in the cross-sectional form and size of the trough itself.

METHOD AND APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,617,598. Feb. 15, 1927. George E. Howard, Butler, Pa., assignor, by mesne assignments, to Hartford-Empire Co. Filed 2/17/22. The method of feeding molten glass that comprises bringing the glass above a downwardly opening outlet, and forming freely-hanging gathers of glass below said outlet by alternate application of downward suction and upward pressure below said outlet.

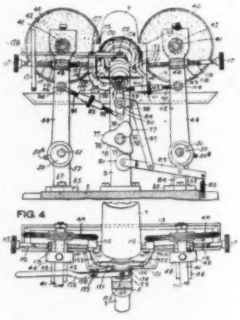


METHOD OF AND APPARATUS FOR SEVERING PLASTIC MATERIAL. U. S. 1,617,861. Feb. 15, 1927. John A. Milliken, Ambler, Pa., assignor to John E. Marsden, Philadelphia, Pa. Filed 4/17/23. A severing device for dividing a stream of molten glass into longitudinal sections comprising a rotatably supported carrier having a passage for the stream of glass, means for continuously rotating said carrier relative to said stream and in one direction, blade members mounted on the carrier so as to reciprocate transversely of said passage and to travel in an orbit around said stream, a slidably supported gear ring surrounding said carrier, said gear ring being unaffected by rotation of said carrier, actuating levers for said plate members also mounted on said carrier, said levers having portions engaging said gear ring, and means for reciprocating said gear ring.



ACTINISM-PROOF REINFORCED GLASS, U. S. 1,604,761. Oct. 26, 1926. James H. Sherts, Newark, N. J., assignor to E. I. duPont de Nemours & Co. Filed 3/12/26. The use of laminated safety glass with one or more laminations of pyroxylin plastic as a colorless transparent window is comparatively limited, chiefly for the reason that the strengthening layer of plastic material frequently becomes colored or discolored in the course of time, indicating deterioration. The inventor claims to have devised a safety glass that, while entirely satisfactory as an actinism-proof article, is yet capable of production at a cost sufficiently low to make the glass commercially practicable. In the present invention actinic-ray-absorbing or arresting ingredients are incorporated in the safety glass structure. A variety of colors stable to sunlight and which when compounded in an actinic-ray-filtering stratum produce amber, yellow, orange, as well as violet, red, green, and blue, may also be used. In safety glass of the present invention there is used, with the glass layer and the strengthening layer, a layer which itself constitutes a ray screen, the ray-arresting ingredient being embodied in this layer and the layer being of some material, as a thin sheet of gelatin or transparent pyroxylin plastic, in which the ingredient is easily incorporated.

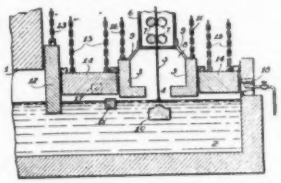
GLASS-CUTTING MACHINE. U. S. 1,615,978. Feb. 1, 1927. James Boyd Greer, Pittsburgh, Pa. Filed 9/14/23. Relates to machines for cutting designs upon tumblers, goblets, vases and hollow glassware in general. Objects are to provide a glass cutting machine having a wide range of adjustments and wherein friction shall be reduced by eliminating the slides which have heretofore been employed, in which the necessity of specially dressing the grinding wheels to conform to various shapes of ware is eliminated.



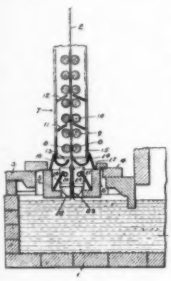
A still further object is to provide a glass-cutting machine having indicating means whereby the machine may be quickly and accurately set up for various designs without requiring great skill on the part of the operator.

GLASS CUTTER. U. S. 1,606,802. Nov. 16, 1926. Chas. W. Kurtz, Pittsburgh, Pa., and Edward J. Stein and John W. Crolley, Arnold, Pa., assignors to Window Glass Machine Co.

SHEET-GLASS DRAWING APPARATUS. U. S. 1,615,862. Feb. 1, 1927. Charles H. Wright, Clarksburg, W. Va., assignor to Pittsburgh Plate Glass Co. Filed 5/24/26. Designed to improve the temperature control and at the same time dispense with the use of the gas burners during the operation of drawing sheet glass, such burners being employed only at those intervals when the drawing operation is discontinued and it is desired to recondition the bath by bringing the body of glass in the tank and particularly the surface portion to a temperature considerably above the normal drawing temperature.



GLASS-CONTAINER BOX CAR. U. S. 1,616,605. Feb. 8, 1927. Edmund D Campbell, St. Louis, Mo., assignor to American Car and Foundry Co., New York, N. Y. Filed 12/12/24. Apparatus for shipping material in block formation comprising packing frames for the several blocks, and a rack with means for securing the several packing frames.



APPARATUS FOR MAKING SHEET GLASS. U. S. 1,615,863. Feb. 1, 1927. Charles H. Wright, Clarksburg, W. Va., assignor to Pittsburgh Plate Glass Co. Filed 5/24/26. Means in a sheet glass drawing chamber for preventing inward movement of the edge of the sheet, comprising a shielding plate spaced above the surface of the pool but closely adjacent thereto and having a slot extending inward from its edge and fitting around the edge of the sheet, and a cooling member, with its inner end positioned immediately above said plate.

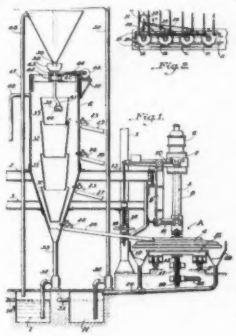
METHOD OF POLISHING PLATE GLASS. U. S. 1,618,085. Feb. 15, 1927. Philip J. Hess, Kokomo, Ind., assignor to Pittsburgh Plate Glass Co. Filed 10/30/19. A process of polishing plate glass upon a table provided with relatively movable runners, which consists in feeding a full supply of rouge mixture consisting of rouge and water to the surface of the glass on the table during the initial period of polishing and then cutting down the supply of rouge mixture and continuing the polishing operation and simultaneously supplying an additional quantity of water to the table.

PROCESS OF COLORING GLASSWARE. U. S. 1,615,973. Feb. 1, 1927. Martin L. Burgess, Indianapolis, Ind., assignor to the Marietta Manufacturing Co. Filed 11/17/23. The process of producing colored glassware consisting in mixing with each batch a coloring medium in the furnace for coloring the glass throughout the body thereof, rolling the colored molten glass into a substantially flat slab of desired thickness, spraying on the surface while still hot from the rolling operation a solution of copper sulphate and sulphuric acid dissolved and diluted with water, and thereafter passing the glass through an annealing oven for causing the surface coloring produced by said solution to be thoroughly baked and hardened therein.

DEVICE FOR COATING ARTICLES WITH GLASS, ENAMEL, QUARTZ AND METALS. U. S. 1,617,166. Feb. 8, 1927. Max Ulrich Schoop, Zurich, Switzerland. Filed 1/13/22. In a device for coating articles, particularly with glass, enamel, quartz, metals and the like, a receptacle for the pulverulent coating material, adjustable means arranged at the bottom of said receptacle for admitting a stream of compressed combustible gas, nozzle means, means for supplying oxygen and two combustible gases to said nozzle means for producing a blowpipe flame, means connected to the top of said receptacle for conveying the stream of gas and the material suspended therein to said nozzle means for projecting the material, the particles of which are heated to a high temperature by the combustion of the conveying agent, to the article to be coated, and baffle means provided above the body of material in said receptacle for attaining a uniform suspension.

FURNACE FOR HEATING GLASS BLANKS. U. S. 1,617,955. Feb. 15, 1927. Karl G. Kutchka, Wilkinsburg, Pa., assignor to Pittsburgh Plate Glass Co. Filed 6/10/25. In combination, a furnace for heating blanks, comprising a tunnel chamber open at the bottom, an endless carrier for blanks to be heated fitting into the bottom of the chamber and comprising a plate for supporting the blanks with a longitudinally extending supporting rib extending downward from the center of the plate, a longitudinally extending heating chamber on each side of the rib, gas heating means for said chambers, and means for moving the carrier forward to shift the blanks forward through the length of the tunnel chamber.

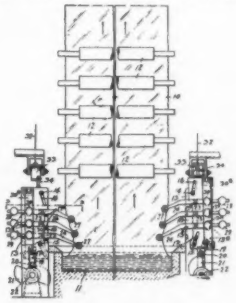
GLASS-GRINDING PROCESS AND APPARATUS. U. S. 1,615,833. Feb. 1, 1927. Frederick Gelstharp and Joseph C. Parkinson, Tarentum, Pa., assignors to Pittsburgh Plate Glass Co. Filed 12/31/24. A process of grading and applying abrasive to a grinding machine, which consists in collecting the used abrasive and water from the grinding machine, separating a portion of the water from such mixture and causing it to flow upward through a body of water, introducing the remainder of the mixture into the top of such body and simultaneously withdrawing a mixture of water with the desired grade of abrasive from said body and supplying it to the grinding machine.



PROCESS OF MAKING ROUGE. U. S. 1,618,086. Feb. 15, 1927. Philip J. Hess, Sr., Kokomo, Ind., assignor to Pittsburgh Plate Glass Co. Filed 10/30/19. The process of preparing a polishing rouge mixture which consists in heating ferrous sulphate until the water of crystallization is driven off and substantially all of the sulphate changed into a compound comprising ferric oxide and basic ferric sulphate, in the approximate proportion of two parts by weight of oxide to one of sulphate, and then mixing the compound with water in the approximate proportions of one pound of the compound per four and one half gallons of water.

APPARATUS FOR APPLYING ABRASIVE TO PLATE GLASS GRINDING MECHANISM. U. S. 1,618,063. Feb. 15, 1927. George W. Oakes, Crystal City, Mo., assignor to Pittsburgh Plate Glass Co. Filed 4/18/22. The method of applying sand to a grinding machine which consists in collecting a measured quantity of new abrasive in a solid mass in a supply hopper located above the machine, washing such abrasive directly to the table in an ungraded condition by supplying water thereto sufficient to provide a relatively thick mixture, rough grinding with such mixture, collecting the abrasive and water from the machine and supplying them to a grader, and thereafter regrading and reusing the abrasive.

APPARATUS FOR FORMING SHEET GLASS. U. S. 1,616,371. Feb. 1, 1927. George E. Howard, Butler, Pa., assignor to the Hartford-Empire Co. Filed 4/13/26. Apparatus for forming sheet glass, comprising means for drawing a glass sheet from a molten bath, sheet-stretching means interposed between said drawing means and said bath, a member pivotally supporting said sheet stretching means, means for moving said member in the same general direction as the sheet, and means for causing said member to move at an angle to said direction.



FURNACE. U. S. 1,600,484. Sept. 21, 1926. Michael J. Owens, Toledo, O. By administrators, assignors to The Owens Bottle Co. Filed 9/20/24. The invention relates to the combination of a furnace and a circulating system through which air for combustion is circulated, the furnace comprising a wall having a channel therethrough opening directly to the outside air, the circulating system having its intake at the channel, whereby fresh air enters directly from the atmosphere into the channel, is heated therein and is drawn from thence into the circulating system.

The Glass World and What It Is Doing

News of the Industry

Vital Question Settled by Pottery Decision

A decision of great significance to the industrial world and likely to exert a far-reaching effect upon manufacturing and other business interests was reached by the United States Supreme Court at Washington, on February 21, when by a vote of five to three the Court upheld the conviction in the district court of Southern New York of twenty individuals and twenty-three corporations engaged in the manufacture and distribution of pottery products in nine different states, and controlling 82 per cent of the production in the country of vitreous bathroom fixtures and similar products.

The case was brought against the Trenton Potteries Company of Trenton, N. J. and the other defendants on indictments charging that they had illegally attempted to fix prices and restrain trade by limiting sales of pottery products to specially designated groups.

In an opinion by Associate Justice Stone the Court reiterated the "rule of reason" as outlined in its decisions in the Standard Oil and Tobacco Trust cases, holding that there might be a restraint of trade even where prices are reasonable, and that "the reasonable price fixed today may through economic and business changes become the unreasonable price of tomorrow."

It approved the action of the trial Judge in charging the jury that it might return a verdict of guilty without regard to the reasonableness of the prices fixed, or of the good intentions of the combining units, whether prices were actually lowered or raised or whether sales were restricted to the special jobbers, "since both agreements of themselves were unreasonable restraint."

David L. Podell, the Special Assistant Attorney General, who prosecuted the pottery case defendants in the courts at Washington said, as reported in the *New York Times*, that the decision of the highest court establishes the law in all Sherman law prosecutions, that it clears away much of the uncertainty in the minds of some of the lower courts as to the extent of the responsibility of those engaged in price-fixing combinations and that it would have a tendency to reduce combinations and be of great advantage to the general public.

"The actual punishment of these particular defendants with jail sentences," said Mr. Podell, "is of infinitesimal significance compared to the tremendous issue decided by the court. That it is of nation-wide importance and affects every large industry, particularly in view of the recent tendency toward trade associations, cannot be questioned. The decision puts new life and vigor into the Sherman anti-trust law."

Atlanta's Campaign for Ceramic Factories

Readers of this publication will remember the series of interesting advertisements which appeared in it during the early part of the past year.

A year ago the citizens of Atlanta, Georgia, realized that if the facts about the city and its surrounding area were known to the executives of American business many of them would see the necessity of establishing branch offices and branch factories there. To tell this story, a fund of $250,000 was subscribed and an advertising campaign was begun in trade publications reaching the executives of the most logical industries. In the first ten months of 1926, 136 concerns in various lines went to Atlanta taking in more than seven million dollars in new payrolls.

As a result of that campaign, Atlanta has just raised a fund of $1,000,000 to continue the advertising of the city's advantages during the next three years.

Analyzing the type of material which accomplished the immense results stated above, it is found that before a line of advertising was written, a most careful survey was made to determine the actual advantages offered by the Atlanta Industrial Area. Following this, a second survey was made to determine which industries were most greatly concerned with the resources of the city, and should therefore be approached first. The glass and ceramic industries were among those selected.

It was found that the new tendency in merchandising, hand-to-mouth buying, had made imperative the decentralization of industry. It was shown that it has become necessary for every distributer of merchandise to establish factory branches close to his customers in the major markets of the country. It was pointed out that because of the excellence of its transportation, its strategic location, Atlanta is a center from which the South can be served most efficiently and most economically. An analysis of the South, it was claimed, demonstrates that it supplies a market of prime importance to practically all business. Fifteen railroad lines, radiating from the city, make it the perfect point for the distribution of goods, and the routing of salesmen to this market.

The South has developed amazingly during the past decade, more than tripling its buying power in that time, according to the statements of conservative research organizations. Analysis of the experiences of those who are doing business in Atlanta, showed that not only were selling organizations breaking all records, leading the entire country in volume of sales and increase in business, but factories were also operating with lower costs, were producing far better net profits than similar plants in other sections. This situation was broken down into its factors.

Labor is a major item, it was learned. The workers of the Atlanta district are 97 per cent Anglo-Saxon, with a heritage of loyalty to their employers, a native skill and intelligence which renders them highly efficient—and radically cuts the cost of operation in the Atlanta Area.

Close by Atlanta, it was found, lie great deposits of minerals to satisfy the needs of nearly every branch of industry. Great timber areas are within easy haul. The finest of clays for the ceramic trades — in wide variety — are so placed as to make Atlanta the logical center for the Southern branch of this industry. And the low prices at which these materials can be laid down in Atlanta was another factor of economy. Then, also, Atlanta is the heart of the cotton belt.

The tax situation formed a strong appeal; taxes are low in Georgia. There is no State income tax. There is no State inheritance tax and the State collects 80 per cent of the Federal inheritance taxes levied.

Immense power developments have brought the cost of electric power to a low level. Low building costs, it is claimed, produce economies of more than 20 per cent in comparison with other industrial centers.

It was realized at the beginning, of course, that no industry could be moved purely on the strength of advertising, no matter how crammed with fact, nor how carefully presented, and to supply executives with full information the Atlanta Industrial Bureau was organized. This Bureau, headed by an executive experienced in research, and equipped with every facility and a skilled staff, makes a special, first-hand survey for every interested concern. The market is analyzed, the manufacturing costs are detailed and a report complete in every detail is laid before the enquiring executive. These reports are carefully unbiased. They point out the disadvantages as well as the advantages; they analyze the situation exactly as the enquirer's own engineers would do it.

Harbison-Walker Had Satisfactory Year

The twenty-fourth annual statement of the Harbison-Walker Refractories Company, Pittsburgh, Pa., for the year ended December 31, 1926, shows net operating profits of $3,999,378, a slight increase over 1925. The plants were operated on the basis of 70 to 75 per cent of their rated capacity. The physical condition of the plants has been maintained at the usual high rate of efficiency. Sales prices and costs were practically normal during the period. Business carried over from last year with new business received during January warrants a steady operation of the company's plants for the first quarter of the new year. A normal business year is expected thereafter.

The Plate Glass Inquiry

A discussion of the plate glass situation took place on February 5 before the Senate committee investigating the Tariff Commission. Senator Reed of Pennsylvania, according to the *United States Daily* declared that foreign manufacturers of plate glass were conducting a drive in this country to control the domestic markets, and were selling their product in American markets below the domestic cost of production. He brought up the plate glass situation, he said, to ascertain from David I. Lewis, a former commissioner, a solution for remedying the situation. Mr. Reed said the commission had before it an inquiry covering production costs of plate glass in this country and abroad, but that no action has been taken by the commission. John F. Bethune, secretary of the commission, who was present, said the plate glass inquiry was pending and that no definite date has been set for the issuance of any preliminary data in connection with investigation. He said that the delay was due to the fact that the members of the commission had been engaged in connection with the work incident to the hearings before the Senate committee. He said that the commission plans to issue such a preliminary statement and also to have further public hearings in the matter.

Sheffield Technologist Enters Industrial Field

Dr. S. English, who for more than ten years has served in the Glass Department of the University of Sheffield, during the latter part of which period he held the position of Senior Lecturer, has left academic life and taken a technical post in industry, having been appointed to head the research department of Holophane, Ltd., of Westminster, S. W. 1, London, manufacturers of reflectors and illuminating glassware. The many American friends of Dr. English who highly appreciate his work at the University and his published scientific papers will wish him every success in his new environment.

Window Glass Prices Reduced

A temporary reduction of 6 per cent in the prices of window glass of B quality single strength, in all brackets, effective February 23 and to continue in force until March 17, 1927, has been announced by the American Window Glass Company. Buyers will be protected against further decline up to June 15, 1927. On and after March 18 the prices in force prior to the reduction in prices will again prevail.

A reduction averaging about 10 per cent was made in the prices of plate glass on January 26 by the Pittsburgh Plate Glass Company, followed by similar action by the Standard Plate Glass Company and the American Plate Glass Corporation. The opinion was expressed in some quarters that the cut in price was caused at least partly by the Ford Motor Company having a larger production of glass from their three factories than can be utilized in the Ford cars under present conditions are said to be disposing of it to outside buyers at low prices.

An example of the changed financial conditions which are bringing foreign business organizations to this country for capital is the case of the First Bohemian Glass Works, Ltd., a large Czechoslovakian industry, which has arranged with a New York financial house for the floating of a gold loan of $1,500,000, consisting of 30 year sinking fund gold bonds with stock purchase warrants. The purpose of the issue is to liquidate the company's bank loans and provide additional working capital.

The Society of Glass Technology will hold its tenth annual meeting on April 27, 1927. Officers have been nominated for the ensuing year as follows: President, Walter Butterworth; vice-presidents, H. A. Bateson and W. J. Rees; ordinary members of council J. D. Cauwood, F. Graves Clark, Miss V. Dimbleby, G. V. Evers and W. W. Warren; treasurers, general, Joseph Connolly, and American, F. C. Flint; secretary, Prof. W. E. S. Turner.

New Mirror List

At a meeting of the Mirror Manufacturers' Association held in Pittsburgh, early in February, the members adopted the new mirror list and it is now in force. Copies of the list may be procured from the publishers, William G. Johnston Company, Pittsburgh, Pa.

Trade Activities

Wells Glass Company, Kokomo, Ind., increased its capital stock from $200,000 to $300,000.

Pine Glass Corporation, Okmulgee, Okla., has been incomporated with a capital of $300,000 by O. A. Bingman, 824 N. Central Street.

The Ohatchie Glass Manufacturing Company of Alabama, will erect a plant, it is reported, for making bottles, etc., at Montgomery, Ala.

Van Tuyl, Heartt & Barron, engineers, Detroit, Mich., announce the removal of their offices to 916 Francis Palms building, Woodward avenue and Elizabeth street.

The Harshaw, Fuller & Goodwin Company, manufacturers and dealers in glassmakers' chemicals, etc., are now located at 1610 Hanna Building, Cleveland, Ohio.

Steere Engineering Company has moved its headquarters from Detroit, Mich., to the office of the Semet-Solvay Engineering Corporation, 40 Rector street, New York.

Ball Brothers Company's glass plant at Hillsboro, Ill., is shut down to permit the making of enlargements and improvements. The furnace will be rebuilt and new lehrs installed.

The Buckeye Plate Glass & Mirror Company, Fort Wayne, Ind., has been incorporated with a capital of $30,000 to deal in glass products. Incorporators are: Charles A. Smith, Raymond A. Blair, Edmund H. Hughes.

The Mathieson Alkali Works, Inc., New York, has appointed F. J. Durner of 5220 Ellsworth avenue, Pittsburgh, Pa., to take charge of sales of soda ash and other products, in the Pittsburgh territory.

The Pierce Glass Company, manufacturers of proprietary bottles, etc., has moved its main office from 665 Main street, Buffalo, N. Y., to Port Allegany, Pa., where the company's factory is located.

The Blue Ridge Glass Corporation, Kingsport, Tenn., is reported to have let contracts for a reinforced concrete and steel addition, 375x28x20 feet, a connecting building, 40x80 feet and two side buildings, 20x40 feet and 20x20 feet. F. F. Shetterly is in charge.

Zihlman Glass Company, Cumberland, Md., has applied for incorporation papers. Albert E. Zihlman and James J. Kirk are interested. Capital will be $75,000. A new plant with 15-ton continuous tank is contemplated. Tumblers and art glassware will be produced.

The Artcraft Metal Products Company, Columbus, O., has leased the factory formerly occupied by the Davies Glass & Manufacturing Company at Martins Ferry, O., and will remodel it for the manufacture of porcelain and enamelled gas ranges.

Torstenson Glass Company, 3233 North Sheffield avenue, Chicago, Ill., has been incorporated with a capital of $37,500 to deal in flat glassware of all kinds. The incorporators are: Elmer L. Torstenson, John A. Torstenson, Henry A. Torstenson and Alfred E. Studt.

The board of directors of the **Libbey-Owens Sheet Glass Company,** Toledo, O., declared a quarterly dividend of 1¾ per cent on the outstanding preferred stock of the company and 50 cents per share on the outstanding common stock, payable March 1, 1927, to stockholders of record at 3 P. M., February 19, 1927.

Pittsburgh Plate Glass Company is making improvements in their window glass plant at Clarksburg, W. Va., including the conversion of one of the two tanks at that plant to the flat glass drawing process developed by the company at its Mt. Vernon, O., plant. It is expected that the production of flat glass will begin about July 1. The other tank will continue to be used for cylinder glass. The improvements will result in the employment of a large number of additional workers.

The Owens Bottle Company has practically completed improvements at its Huntington, W. Va., plant which formerly belonged to the Charles Boldt Glass Company, and which, according to D. E. Andrews, plant manager, will increase production and result in the addition of about 250 employes to the pay roll during the next two months. When the remodeling of the plant was announced some time ago it was stated that the sum of $750,000 would be spent on it. During the alterations production operations were maintained at a reduced rate.

Paul Wissmach Glass Company lost its opalescent glass factory and stock room at Paden City, W. Va., by fire on February 18. A contract was immediately let to the Truscon Steel Company, Youngstown, O., for a new steel and concrete building about 120 x 240 feet and a new stock room, 60 x 305 feet. The buildings in which the wire and rolled glass, etc., are made were not damaged. The company, through A. P. Vollmar, announces that orders for colored glass will be filled from a large stock carried in their Long Island City, N. Y., warehouse and that operations in the colored glass department will be resumed in a few weeks, with better manufacturing facilities than ever.

Hazel-Atlas Glass Company, on February 22, presented to the stockholders of the company at their annual meeting a statement of the financial conditions of the company as of December 26, 1926. The statement showed a highly satisfactory situation at the end of the year's operations, especially as the market had been highly competitive. After spending $791,706 for maintenance and betterments, charging $571,124 for depreciation and providing for federal taxes and contingencies, the net profit was $2,234,339. During the year the company's bonded indebtedness was eliminated at a cost of $1,153,754; in addition, the Owens Bottle Company's holdings in the company were purchased for $3,688,992, these two purchases amounting to $4,842,746.

The Lippincott Glass Company's plant at Alexandria, Ind., according to an announcement made in February, has been acquired by the **Aladdin Industries, Inc.,** a subsidiary of the Mantle Lamp Company of Illinois. The company has offices in various countries and throughout the United States. It manufactures a large variety of products, including lamps and lanterns in which incandescent mantles are used. It is stated that the company will produce its own glass such as chimneys and shades, and a line of vaccum bottles, especially the larger sizes. S. D. Goodwin will be general factory superintendent. The mantle-making department and later the wick weaving and metal working departments will be moved from Chicago to Alexandria. The glass making will be only a comparatively small part of the operations.

Butterworth Bros., Ltd., proprietors of Newton Heath Glass Works, Manchester, England, makers of industrial glass and of fine table glass, recently announced the purchase of the good-will and plant of Robert Easton & Company, mold makers, of Manchester, and henceforth will carry on the business under their own name. Besides this acquisition the company has successively bought from time to time, or absorbed by arrangement, James Bridge & Company, glass manufacturers; Burtles, Tate, Ltd., flint and table glass manufacturers, and also acquired property of John Rowbottom & Son for their glass factories at Newton Heath, and have built extensive additions to their own premises. An erroneous report has been circulated in the press that the company had purchased the glass works of the former Automatic Bottle Makers, Ltd., in Trafford Park, Manchester, for £70,000. The purchase of this plant was considered but finally decided against.

What Our Advertisers Are Doing

The Bethel Engineering Company, through A. Rutledge Bethel, report the shipment in February of a Bethel feeder to the Bartlett-Collins Glass Company, Sapulpa, Okla., manufacturers of pressed and blown, and light cut and decorated ware.

The Chapman-Stein Furnace Company, Mt. Vernon, O., recently received from the Weston Glass Company a contract for one standard 60 by 100 foot recuperative day tank, which will be the first of its type to be installed in their plant at Weston, W. Va.

The Austin Company, New York, whose activities as engineers and builders are well known throughout the glass field, are now placing orders to cover their 1927 material requirements. The company maintains large stocks of structural steel, steel sash, lumber, putty, and factory ribbed, clear and wire glass. Most of these materials are stocked at Cleveland, Philadelphia and Chicago. Because of the country-wide activities carried on by the company through branch organizations in numerous cities, large quantities of building materials and other miscellaneous items are purchased locally. Some idea of the quantity of materials purchased locally or carried in stock in anticipation of meeting the Austin Company's requirements for 1927 may be had from the following figures: glass, 2,000,000 square feet; structural and other steel, 35,000 tons; lumber, 20,000,000 feet; brick, 30,000,000; cement, 484,000 barrels; paint, 75,000 gallons; putty, 1,000 tons. The total value of these and the other materials listed to be purchased adds up to approximately $10,000,000.

Personals

Harry C. Sorden, secretary of the Mirror Manufacturers Association, has moved his office from Shelbyville, Ind., to Room 614, Congress Hotel, Chicago, Ill.

C. P. Overmyer, president of the Overmyer Mould Company, Winchester, Ind., started in February on a business trip to the west, southwest and Pacific Coast. He will go as far as Los Angeles and San Francisco.

Irving E. Adams, the well known glass consultant, has changed his location from Reading, Pa., to Pittsburgh, with mail address in care of the D. O. Cunningham Glass Company, Pittsburgh. Mr. Adams recently resumed his practice in the glass field and during the past few weeks has been serving various well known factories in an advisory capacity.

M. G. Babcock has been appointed manager of the Refractories Department of the Pittsburgh Plate Glass Company to succeed the late A. Hart Chandler, whose death occurred on January 26. Mr. Babcock had been assistant to Mr. Chandler for a number of years. Official announcement of the appointment of Mr. Babcock was made on February 7, by H. S. Wherrett, vice-president of the company.

R. S. Ellinwood has resigned from the Huntington, W. Va., plant of Ball Brothers Company and has moved to Baltimore, Md., to become manager of the machine production department of the Carr-Lowrey Glass Company, manufacturers of prescription, perfumery and novelty bottles. Mr. Ellinwood was manager of the Schram Glass Manufacturing Company, Huntington, when that plant was purchased by the Ball Brothers Company of Muncie, Ind., and continued there as plant manager after the change in ownership.

Richard O. Stilwell, for the past seven years superintendent of the Butler, Pa., plant of the Standard Plate Glass Company, has resigned his position with that company. Mr. Stilwell, prior to his connection with the Standard Plate, was formerly with the American Optical Company of Southbridge, Mass., and has had extensive experience in the glass business. The Butler plant during Mr. Stilwell's service and under the general management of F. E. Troutman has nearly doubled its production.

Anthony Scalise, former president of the Columbia Glass Company, Fairmont, W. Va., is reported to have acquired the property of the Florida Glass Manufacturing Corporation, Jacksonville, Fla., and will, it is said spend $150,000 in renovat-

ing the plant and putting it into operation. It is said that the initial capacity of the factory will be from two to four carloads of preserve jars, milk bottles and other glass containers per week. The Florida trade will be catered to and foreign business developed.

William C. Cole, manager of the Fairmont, W. Va., plant of the Owens Bottle Company, has resigned that position and has become president and general manager of the Columbia Glass Company, also in Fairmont. J. T. Sloan will continue with the Columbia Company as plant superintendent, and N. J. Doman, formerly superintendent of the mold and machine department of the Owens Company, will have a similar position with the Columbia Glass Company. The principal products of the Columbia Company are opal glass jars and containers.

Thomas H. Morris has been appointed manager of the Huntington, W. Va., plant of Ball Brothers Company. Mr. Morris, who was manager of the Huntington plant when it was owned by the Schram Glass Manufacturing Company and until it was purchased by Ball Brothers Company over a year ago, had been in charge of the Muncie, Ind., plant of the Ball Brothers Company. Extensive repairs are now being made to the Huntington plant and it is expected that it will resume operations about April 1, with a force, according to reports, of over approximately 350 men.

Recent Deaths

Charles C. Stutz

Charles C. Stutz, connected with the Pittsburgh Plate Glass Company for many years as assistant chief engineer, died at his home in New York on January 28 at the age of 65. Mr. Stutz was a member of the American Institute of Electrical Engineers.

Thomas F. Pickett

Thomas F. Pickett, superintendent, until about a year ago, of the Atlas factory of the Hazel-Atlas Glass Company, Washington, Pa., died at his home in that city on February 15. Mr. Pickett became connected with the Hazel-Atlas Glass Company in 1887, and later became superintendent of the Hazel No. 1 factory. About 1918 he was transferred to the Atlas factory.

Louis Kauffeld

Louis Kauffeld, vice-president and general manager of the Louis Kauffeld Illuminating Company, Star City, W. Va., with which his four surviving sons are connected, died at his home in that city on January 23 from pneumonia. Mr. Kauffeld, one of the early glass manufacturers of the state, started his career in the glass field in a small way in 1896, and established a number of different glass factories during his life time, his activities culminating in the development of the plant he was connected with at the time of his death.

Inquiries Received

355. We desire quotations on the following chemicals c. i f. c. i. Bombay, India. Terms of payment 30 to 60 days documents against acceptance, or possibly payment against shipping documents at the shipping port: selenium metal black powder 99/100%, cadmium sulphide, uranium oxide orange zinc oxide white 99/100%, zinc dust, barium carbonate 99/100%, potash carbonate, potassium cyannide, borax, liquid gold 10% and 12%, liquid silver. Reference: Chartered Bank of India, Australia and China, Ltd. Delhi, India. Quotations are requested based on ton lots (English 2240 pounds). Address: Bishva Nath Gupta, importer and merchant, Magazine House, Delhi, India. (Jan. 13.)

356. We would like the names of manufacturers of glass cylinders for use on gasoline pumps. (Feb. 2.)

357. Kindly give me the names of concerns making glass containers suitable for canning purposes. (Feb. 3.)

358. I would like to secure the names of manufacturers of glass which permits ultraviolet rays to pass through. (Feb. 4.)

359. We understand that continuous sheet glass is being made that is colorless when looked at edgewise. Can you tell us who makes it in sheets of ⅛ or 1/10 of an inch thick and 8 by 10 inches in size? (Feb. 1.)

360. Will you kindly furnish the addresses of manufacturers of the necessary machinery to make little glass squares, ten by ten millimeters square by five millimeters high, and also little pyramids ten by ten millimeters at the base by five millimeters high. These squares and pyramids are to be made of colored glass. (Jan. 30.)

361. Who makes Sani-Onyx or a glass similar to it? Feb. 23.)

362. Will you kindly supply us with names of three or four manufacturers of rolled glass as we wish to submit specifications for a car of maze, moss, Florentine, and ribbed wire. (Feb. 17.)

363. I am an importer located in Colombia, Ceylon, and would appreciate receiving the names of concerns in your country which would be interested in exporting glass and crockery to Ceylon. Can give satisfactory references.

364. We are in the market for large quantities of bent glass tubes made from tubing 12 inches long, with outside diameter about ⅜ inch, bent an irregular U shape. Can you give us the names of glass companies that would be in a position to make this tubing for us?

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, FEB. 19, 1927

Reported by Moore, Leonard & Lynch, Union Trust Building, Pittsburgh, Penna.

	BID	ASKED	LAST
American Window Glass Machine, com.	....	....	50
American Window Glass Machine, pfd..	....	....	77
American Window Glass, pfd.....	....	109	108
United States Glass.....	13	....	13
Pittsburgh Plate Glass, com.....	....	....	239
Standard Plate Glass, com.....	....	....	3¼
Standard Plate Glass:			
Preferred cumulative.....	....	20	18
Prior preferred.....	....	65	68

TOLEDO STOCK EXCHANGE

February 19, 1927

	Bid	Asked	Last
Owens Bottle Machine, com.....	115½	117	115
Libbey-Owens Sheet Glass, com.....	141	142	142
Libbey-Owens Sheet Glass, pfd.....	115	..	115

WHEELING STOCK EXCHANGE

February 18, 1927

	Bid	Asked	Last
Hazel-Atlas	..	..	48½
Imperial	..	..	72
Fostoria	..	..	150
Central	..	..	75

READERS WANTS AND OFFERS

Experienced Decorator Wanted

Large manufacturer of illuminating glassware in middle west will entertain applications from experienced decorators of lighting glassware, qualified to take complete charge of decorating department. Must be thoroughly versed in handling of colors, designing and kiln operation. In writing state age, experience and salary desired. Address, MIDDLE WEST, care GLASS INDUSTRY, 50 Church Street, New York.

Labelling Artist

Glass and china decorator, specialist in decorating pharmaceutical and chemical bottles and fancy glass, also experienced with etching steel and copper plate for different printing purposes, (hotelware, etc.); good sign painter on shields (china and enamel), desires permanent position. Decorator, care of THE GLASS INDUSTRY, 50 Church St., New York.

Current Prices of Glass-Making Materials

February 21, 1927

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid:			
Citric	lb.	.43½	.43½
Hydrochloric (HCl) 20° tanks, per 100 lb.		.95-1.05	..
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.00-16.00	..
Tartaric	lb.	.30½	.30½
Alcohol, denatured	gal.	..	.40
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.06½
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.20-.21
Ammonia water (NH_4OH) 26° drums	lb.	..	.03
Antimony, metallic (Sb)	lb.	..	.14½
Antimony oxide (Sb_2O_3)	lb.	..	.16½
Antimony sulphide (Sb_2S_3)	lb.	.15	.16½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.03¾	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	55.00	60.00
Natural, powdered, imported	ton	48.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08½	.10
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04	.04¼-.04¾
Boric acid (H_3BO_3)	lb.	.08	.08½-.09¼
Refined	lb.	.08-.09½	.08½-.10¾
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.05-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.28	.29
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	..	.30
Cryolite ($Na_3Al F_6$) Natural Greenland			
Kryolith)	lb.	..	.09¼-.09½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		1.20	1.30
Feldspar—			
100 mesh	ton	11.00-20.00	16.00-22.00
80 mesh	ton	13.50	..
40 mesh	ton	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	40.00	40.00
" " 90%	ton	38.00	..
Formaldehyde	lb.	.11¼	.11¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02-.03
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb	.10¾	.10¾-.11
Litharge (PbO)	lb.	.10¼	.10¼-.10½
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.04	.04½
light (in bbls.)	lb.	.22	.24
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06¼	.08
Manganese 85% (MnO_2)	lb.	.04½	.05
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08	.08¼
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.06¾
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07¼	.07⅝
Potassium nitrate (KNO_3) (gran.)	lb.	.05½-.06	.06¼-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.14	.14½
Powdered blue	lb	..	.24-.26
Rochelle salts, bbls.	lb.	..	.20
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz	..	.42
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb	1.27½-1.35	..
In barrels	Per 100 lb.	1.57½-1.69	2.40
In bags	Per 100 lb.	1.37½-1.45	..
Spot orders .05 per 100 lbs higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¼	.06¾
Sodium hydrate (NaOH) (caustic soda)	Per 100 lb.	..	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04⅛
95 per cent	Per 100 lb.	2.66	2.85
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.25
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy, in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$)) (crystals)	lb.	..	.47
Tin oxide (SnO_2) in bbls.	lb.	..	.70
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.30-2.25
Zinc oxide (ZnO)	lb.	.06½	.07

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to January 26, 1927

	December 1925 Quantity	December 1925 Value	December 1926 Quantity	December 1926 Value	Twelve Months Ending December 1925 Quantity	Twelve Months Ending December 1925 Value	Twelve Months Ending December 1926 Quantity	Twelve Months Ending December 1926 Value
Glass and glass products (total)	.....	$872,078	.....	$719,942	.....	$8,579,970	.....	$9,171,092
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,231	7,811	2,185	17,101	25,131	143,313	30,976	184,206
Plate glass, unsilvered, sq. ft.	194,686	40,100	36,261	12,460	1,578,657	407,440	855,157	243,371
Other window and plate glass lbs.	185,567	17,950	355,957	25,169	2,447,333	272,891	3,026,006	271,941
Glass containers (bottles, vials and jars)	.....	322,676	.....	197,166	.....	2,937,071	.....	3,103,944
Table glassware, plain	.....	167,528	.....	143,346	.....	1,753,628	.....	1,662,342
Table and other glassware, cut or engraved	.....	10,818	.....	9,933	.....	160,236	.....	171,925
Lamp chimneys and lantern globes lbs.	169,181	39,705	165,306	31,912	1,867,673	356,417	2,033,812	385,994
Globes and shades for lighting fixtures lbs.	167,002	46,881	177,289	60,558	1,657,599	494,947	1,777,532	598,210
Chemical glassware lbs.	19,122	20,451	19,026	16,910	226,798	196,790	226,683	205,854
Electrical glassware, except for lighting lbs.	159,097	17,451	222,143	36,518	2,664,380	269,962	4,881,273	485,593
Other glassware	.....	180,707	.....	168,869	.....	1,587,275	.....	1,857,712

IMPORTS

Corrected to January 26, 1927

Glass and glass products (total)	.....	1,242,648	.....	1,717,876	.....	17,380,134	.....	20,874,541
Cylinder, crown and sheet—								
Unpolished dut. lbs.	2,983,770	166,461	7,921,428	284,704	45,880,778	2,408,907	81,633,934	3,191,238
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	46,980	.....	52,385	.....	535,378	.....	548,269
Plate glass dut. sq. ft.	1,404,730	469,672	2,340,165	767,160	17,257,055	7,277,508	26,664,263	8,851,736
Containers—bottles, vials, etc dut.	.....	17,650	.....	18,875	.....	185,811	.....	255,090
Table and kitchen utensils dut.	.....	12,150	.....	22,660	.....	146,405	.....	117,818
Glassware, cut or decorated dut.	.....	234,319	.....	241,476	.....	2,376,837	.....	2,939,436
Blown glassware, n.e.s.—								
Bottles, ornaments, etc dut.	.....	73,620	.....	57,625	.....	1,648,667	.....	1,865,455
Bulbs for electric lamps dut. No.	1,227,550	12,476	1,096,244	11,507	16,929,550	175,417	18,423,972	207,153
Chimneys, globes, shades, etc dut.	.....	77,870	.....	103,803	.....	1,062,467	.....	1,024,803
Articles and utensils for chemical, scientific and experimental purposes dut.	.....	42,276	.....	38,859	.....	379,924	.....	532,401
Other glassware dut.	.....	89,174	.....	118,822	.....	1,182,813	.....	1,341,142